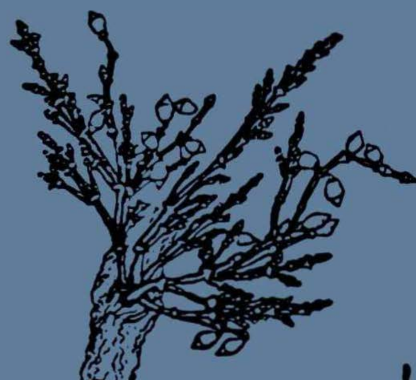
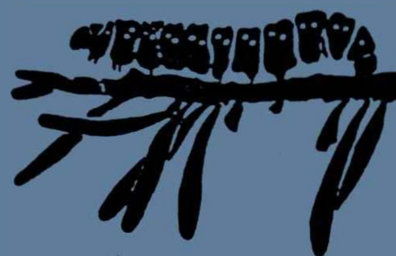
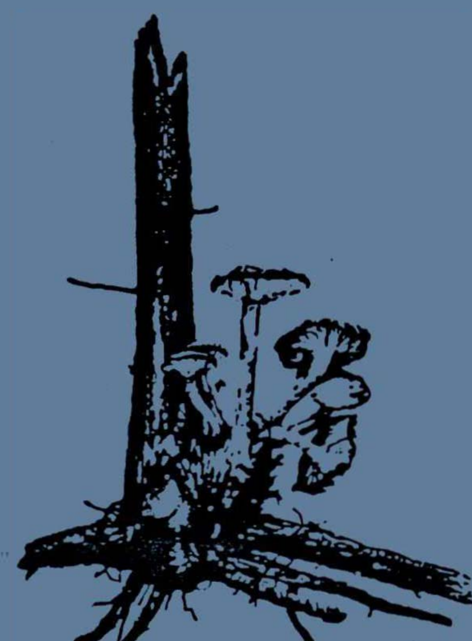
IDAHO FOREST

INSECT & DISEASE CONDITIONS & PROGRAM SUMMARY

1992







IDAHO Department of Lands
USDA Forest Service
Northern & Intermountain Regions

Report No. 93-1

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

IDAHO DEPARTMENT OF LANDS

IDAHO FOREST INSECT AND DISEASE CONDITIONS AND PROGRAM SUMMARY

1992

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INTRODUCTION

This report summarizes major insect and disease damage on forested lands of all ownerships within the State of Idaho for 1992. Much of the information for this report was derived from aerial and ground surveys and associated detection and evaluation activities by pest management personnel within the USDA Forest Service and the Idaho Department of Lands. Losses outlined in tables are only estimates. Likewise, maps outlining areas of major insect infestation provide general locations of problems.

Recently there has been a great deal of discussion about "forest health" and "ecosystem management" or "sustaining ecological systems". These are all terms that refer to a management philosophy that looks at forests as integral components of broad land areas called ecosystems. We are currently in the process of trying to define just what "natural" ecosystems looked like and how they fluctuated over time. Once we understand this, we will be in a better position to evaluate if changes that have occurred are within the range of normal variation or not.

Many of our current pest problems are due to past management practices resulting in unhealthy forests or ecosystems operating out of balance. Our goal is to help maintain natural ecosystem processes by providing ecologically sound insect and disease recommendations and management prescriptions to help increase overall forest health or bring ecosystems back into balance.

This report also includes brief descriptions of many projects insect and disease specialists are involved with in addition to the training and other technical assistance provided on a regular basis.

CONDITIONS IN BRIEF

FOREST INSECTS

The winter of 1991-1992 was very mild and the spring of 1992 was abnormally warm and dry. This resulted in an increase in the numbers of insects surviving the winter and allowed many to emerge as much as a month early. This caused an increase in insect activity in 1992, much of which may not be detected until 1993.

Mountain pine beetle activity doubled from 1991 to 1992 in northern Idaho but much of this increase is due to increased detection of fading western white pine. Mountain pine beetle activity decreased in southern Idaho. Pine engraver populations remain at endemic levels throughout the state. Western pine beetle populations continued to decrease in northern Idaho and remained static in southern Idaho. Douglas-fir beetle populations increased markedly in 1992 throughout the state. In northern Idaho, most activity was widespread and in small groups. Fir engraver activity remained static from 1991 to 1992 in northern Idaho but increased substantially in southern Idaho. There was a large increase in western balsam bark beetle activity in subalpine fir in northern Idaho but a decrease occurred in the southern part of the state. Spruce beetle activity decreased by almost half in northern Idaho and increased slightly in southern Idaho.

Defoliation by the western spruce budworm increased dramatically on the Nez Perce National Forest in northern Idaho but decreased in southern Idaho. Douglas-fir tussock moth defoliation increased in southern Idaho. There was no visible tussock moth defoliation found in northern Idaho in 1992 and trap catches continued to be low. A total of 3 gypsy moths were caught in the state, one each in Pinehurst in northern Idaho, and Filer and Shelby in southern Idaho. Balsam woolly adelgid populations increased significantly in northern Idaho, causing in an increase in subalpine fir mortality.

FOREST DISEASES

Since disease mortality is not usually as apparent as insect outbreaks or forest fires, the extent of losses from diseases is difficult to measure accurately. Root diseases, white pine blister rust, dwarf mistletoes, and nursery diseases continue to cause serious problems throughout much of the state. Although impacts may be quite severe, the aerial surveys which provide most of the data for this report do not usually record these diseases because they are so difficult to detect from the air.

However, needlecast of lodgepole pine was widespread throughout the range of lodgepole pine in north Idaho and western Montana. A partial aerial survey of the Lolo, Panhandle and Clearwater NFs recorded damage on over half a million acres.

We are currently involved in many projects to help managers deal with forest diseases, and brief summaries of these projects are included in this report.

FOREST INSECTS

BARK BEETLES

MOUNTAIN PINE BEETLE

In northern Idaho, total mortality by the mountain pine beetle for all hosts increased from over 9,000 trees in 1991 to nearly 17,000 trees in 1992 (Table 1a, Figure 1). The largest increases occurred in western white pine on the Idaho Panhandle National Forest's (IPNF's) and the Clearwater National Forest (NF). On the IPNF'S, nearly 7,000 western white pine trees were killed in 1992 compared to 128 in 1991. Most of the activity may be an "artificial" increase due to a change in aerial survey techniques or a detection of more than one years mortality. Some may also be a combination of blister rust and mountain pine beetle. Ground surveys in 1993 will help clarify the situation. Most of the activity occurred on the Bonners Ferry and Sandpoint Ranger Districts (RD). On the Clearwater NF, over 1,000 trees were killed in 1992 compared to less than 10 in 1991. Most of the activity there occurred on the Pierce and North Fork RD's. The mountain pine beetle prefers mature, large diameter western white pine. Mortality will probably continue wherever trees in this age class are available.

In lodgepole pine, the major stands affected were on the Bonners Ferry RD, IPNF's, where over 1,200 trees were killed; on the Nez Perce Indian Reservation (IR) where nearly 800 trees were killed; and on the Mica State Forest where nearly 600 trees were killed. About 300 trees killed by the mountain pine beetle were detected on the Pierce RD, Clearwater NF and on the Red River RD, Nez Perce NF. Minor activity occurred in LPP elsewhere. Ground surveys conducted in the Placer Creek drainage, Bonners Ferry RD, revealed an average of 1.2 trees per acre (TPA) currently attacked by mountain pine beetle and 2.4 TPA attacked in 1991. Although beetle populations appear to have decreased slightly in this one area, many high hazard stands remain on the district.

In Ponderosa pine, the greatest mountain pine beetle mortality occurred in the Craig Mountains, where nearly 2,000 trees were killed and on the Nez Perce IR, where 1,200 trees were killed. Scattered white bark pine stands exhibited mortality on the Nez Perce NF (160 trees killed) and IPNF's (26 trees killed).

Lodgepole and ponderosa pine mortality decreased in southern Idaho from 30,400 trees in 1991 to 10,600 trees killed in 1992. The largest center of mortality was located within the Sawtooth National Recreation Area on the Sawtooth NF's. Smaller outbreaks occurred on the Boise and Challis NF's. (Table 1b).

Table 1a. Idaho Statewide summary; annual bark beetle mortality by reporting area: North Idaho

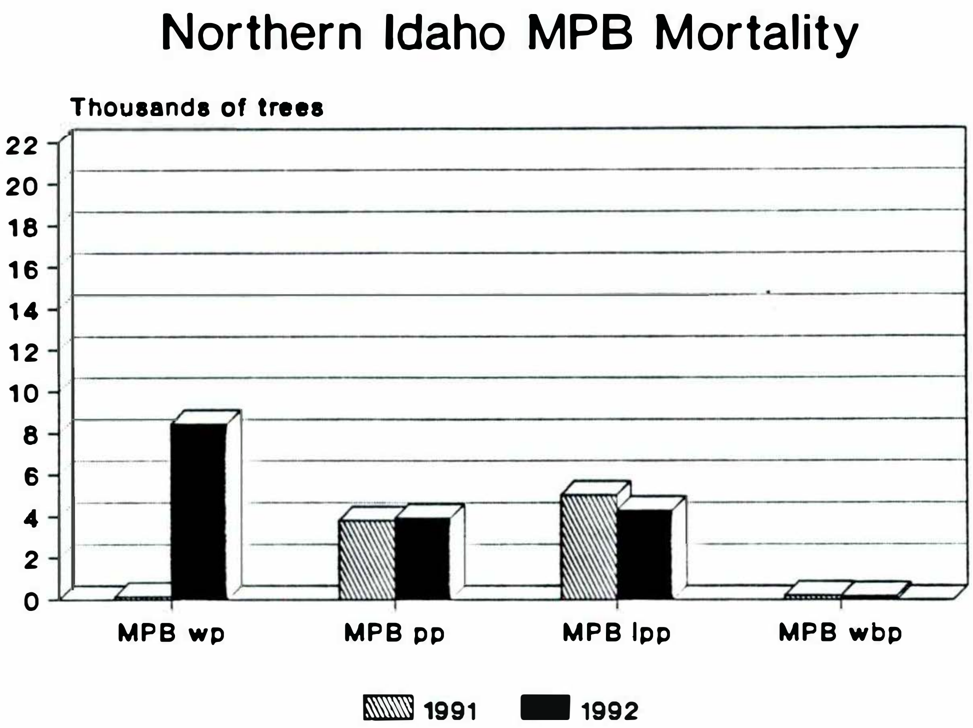
		Mountain Pine Beetle (WP) Estimated Mortality			Mountain Pine Beetle (PP) Estimated Mortality			Mountain Pine Beetle (LPP) Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Bitterroot	1992	0	0	0.0	4	6	0.5	2	5	0.4
	1991	0	0	0.0	0	0	0.0	73	152	13.7
Cataldo	1992	192	358	143.2	19	16	1.3	12	60	5.4
	1991	2	2	0.8	0	0	0.0	30	90	8.1
Clearwater	1992	1,271	1,011	404.4	0	0	0.0	123	474	42.7
	1991	8	6	2.4	6	7	0.6	20	25	2.3
CTPTA	1992	0	0	0.0	0	0	0.0	10	50	4.5
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Craig Mtns.	1992	0	0	0.0	499	1,869	149.5	54	210	18.9
	1991	0	0	0.0	666	3,262	261.0	376	1,790	161.1
IPNFs	1992	7,096	6,813	2,725.2	306	51	4.1	1,321	1,543	138.9
	1991	106	128	51.2	5	36	2.9	327	1,099	98.9
Kendricks	1992	0	0	0.0	0	0	0.0	18	45	4.0
	1991	0	0	0.0	2	5	0.4	4	35	3.1
Kootenai Valley	1992	143	75	30.0	0	0	0.0	2	2	0.2
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Maggie Creek	1992	0	0	0.0	33	28	2.2	4	8	0.7
	1991	0	0	0.0	4	20	1.6	0	0	0.0
Mica	1992	18	34	13.6	131	130	10.4	181	574	51.7
	1991	0	0	0.0	144	393	31.4	10	11	1.0
Nez Perce	1992	83	55	22.0	132	375	30.0	337	335	30.1
	1991	6	26	10.4	0	0	0.0	1,342	1,719	154.7
Pend Oreille	1992	152	157	62.8	36	49	3.9	121	171	15.4
	1991	0	0	0.0	33	100	8.0	17	89	8.0
Priest Lake	1992	2	15	6.0	0	0	0.0	0	0	0.0
	1991	0	0	0.0	0	0	0.0	0	0	0.0
West St. Joe	1992	0	0	0.0	104	300	24.0	15	35	3.1
	1991	0	0	0.0	2	10	0.8	8	20	1.8
Coeur d'Alene IR	1992	0	0	0.0	0	0	0.0	0	0	0.0
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Nez Perce IR	1992	0	0	0.0	310	1,207	96.6	294	785	70.6
	1991	0	0	0.0	0	0	0.0	2	10	0.9
North Idaho Totals	1992	8,957	8,518	3,407.2	1,574	4,031	322.5	2,494	4,297	386.6
	1991	122	162	64.8	862	3,833	306.7	2,209	5,040	453.6

Table 1b. Idaho Statewide summary; annual bark beetle mortality by reporting area: South Idaho

		Mountain Pine Beetle (WBP) Estimated Mortality			Mountain Pine Beetle (PP) Estimated Mortality			Mountain Pine Beetle (LPP) Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Boise	1992	300	1,821	200.3	0	0	0.0	900	643	57.9
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Caribou	1992	0	0	0.0	0	0	0.0	6,700	5,156	464.0
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Challis	1992	300	246	27.1	0	0	0.0	700	1,123	101.1
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Payette	1992	1,800	1,936	213.0	0	0	0.0	100	28	2.5
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Salmon	1992	200	262	28.8	300	262	21.0	200	233	21.0
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Sawtooth	1992	300	412	45.3	0	0	0.0	3,500	4,909	441.8
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Targhee	1992	50	44	4.8	0	0	0.0	50	93	8.4
	1991	0	0	0.0	0	0	0.0	0	0	0.0
South Idaho Totals	1992	2,950	4,721	519.3	300	262	0.0	12,150	12,185	1,096.6
	1991	3,648	8,360	919.6	384	456	36.5	5,168	21,584	1,942.6
State Totals	1992	3,431	4,907	539.8	1,874	4,293	343.5	14,644	16,482	1,483.2
	1991	3,749	8,582	1,483.8	1,246	4,289	343.2	7,377	26,624	2,396.2

There was no Mountain Pine Beetle reported in white pine in Southern Idaho, so the North Idaho totals will be a State Total also.

Don't have a break down by National Forest for Mountain Pine Beetle in 1991, but do have the Totals.



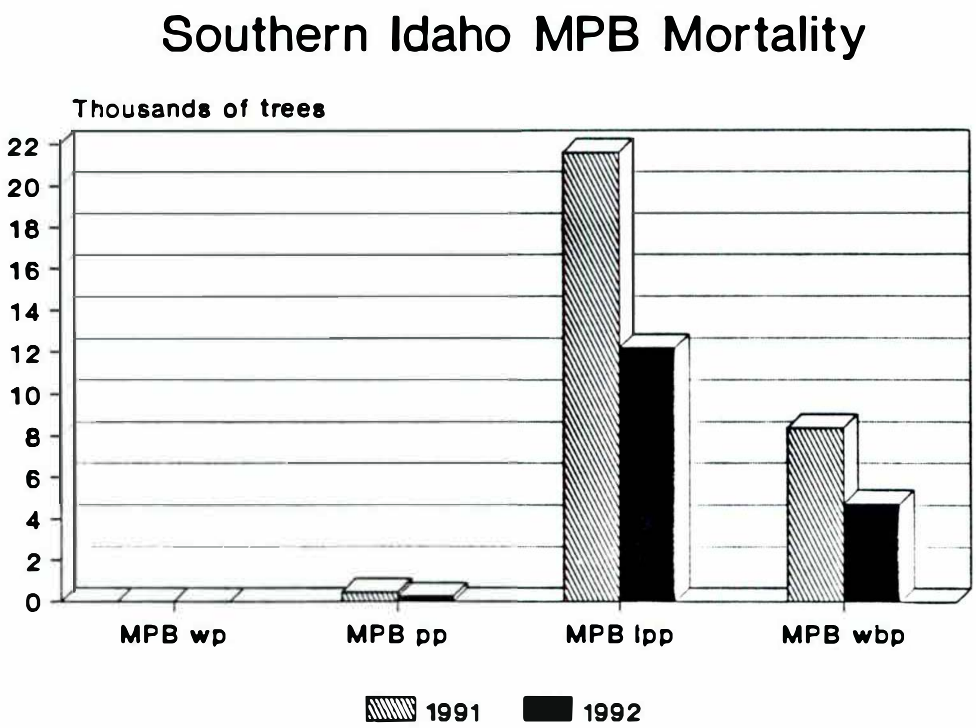


Figure 1. Northern and Southern Idaho
Mountain Pine Beetle Mortality
by Host Species 1991 - 1992

PINE ENGRAVER

Pine engraver populations continued at very low endemic levels in northern Idaho in 1992 (Table 2a, Figure 2). The spring of 1992 was very warm and mild and pine engraver beetles were making new attacks in the middle of March. This may have allowed significant increases in Ips populations that could show up in the future. Flight trapping with pheromone-baited funnel traps caught high numbers of beetles, but since this is the first year of trapping, there is no reference to show if these numbers represent changes in the populations. While the aerial survey tables show only 15 trees on two acres, we know from our flight monitoring that there is a viable population present.

Pine engraver occurred throughout southern Idaho where it is often associated with western pine beetle and jeffrey pine beetle. (Table 2b, Figure 2).

WESTERN PINE BEETLE

Western pine beetle activity in ponderosa pine stands continued to decrease in northern Idaho. In 1992, just over 4,800 trees were killed compared to 6,400 trees in 1991 (Table 2a). Most of the mortality occurred on the Mica State Forest and West St. Joe reporting areas. Small groups of mortality occurred elsewhere.

On the Fernan RD, IPNF's, high value ponderosa pine trees in a campground on Lake Coeur d'Alene were sprayed with carbaryl to protect them from western pine beetle attack. Surveys conducted after beetle flight revealed no sprayed tree was attacked but several unprotected trees in the campground were successfully attacked by the beetle. Currently infested trees will be removed and the area will be thinned to improve the health of the remaining trees and reduce the risk of further mortality in the campground.

Activity in southern Idaho remained relatively static with 8,800 trees killed in 1992 compared to 8,200 trees in 1991. Most activity is located on the Boise and Payette NF's.(Table 2a, Figure 2). Pine engraver attacks were frequently intermixed with western pine beetle activity.

SPRUCE BEETLE

In northern Idaho, total spruce beetle mortality decreased from over 1,500 trees killed in 1991 to about 950 in 1992 (Table 2a, Figure 2). Mortality decreased by more than half on the Nez Perce NF but increased slightly on the Clearwater NF and IPNF's. Spruce blowdown occurred during high winds in October 1991 on the Bonners Ferry RD. By July 1992, frequent attacks by spruce beetles and a secondary beetle, Ips tridens were observed in the downed trees. Because of the risk of beetles emerging from the downed material and attacking surrounding live trees, plans are to salvage the blowdown before the beetles complete their development.

In southern Idaho, spruce beetle activity increased from 23,800 trees killed in 1991 to 32,000 trees killed in 1992 (Table 2b, Figure 2). Most of this increase in mortality occurred on the Payette NF, the only Forest in southern Idaho, with significant spruce beetle activity. Spruce beetle mortality trends from 1985 to 1992 are shown in Table 3.

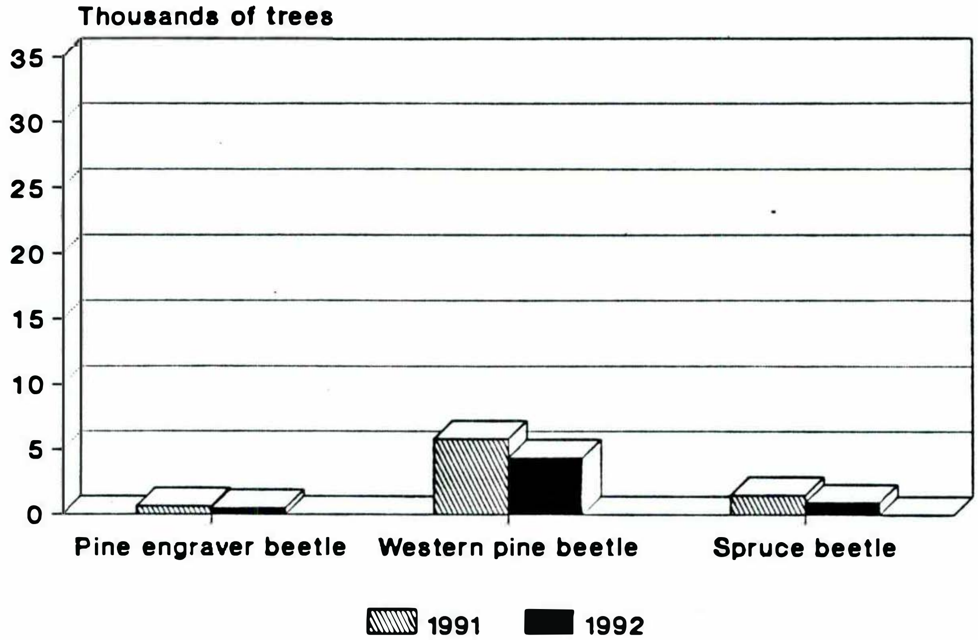
Table 2a. Idaho Statewide summary; annual bark beetle mortality by reporting area: North Idaho

		Pine Engraver Beetle Estimated Mortality			Western Pine Beetle Estimated Mortality			Spruce Beetle Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Bitterroot	1992	0	0	0.0	8	5	2.0	0	0	0.0
	1991	0	0	0.0	34	21	8.4	0	0	0.0
Cataldo	1992	0	0	0.0	11	22	8.8	0	0	0.0
	1991	0	0	0.0	24	43	17.2	0	0	0.0
Clearwater	1992	0	0	0.0	28	52	20.8	221	186	74.4
	1991	0	0	0.0	30	97	38.8	7	9	3.6
CTPTA	1992	0	0	0.0	14	32	12.8	0	0	0.0
	1991	0	0	0.0	34	170	68.0	0	0	0.0
Craig Mtns.	1992	0	0	0.0	45	133	53.2	0	0	0.0
	1991	11	70	1.8	172	1,029	411.6	0	0	0.0
IPNFs	1992	0	0	0.0	319	446	178.4	26	69	27.6
	1991	2	5	0.1	132	243	97.2	8	8	3.2
Kendricks	1992	0	0	0.0	180	623	249.2	0	0	0.0
	1991	0	0	0.0	204	890	356.0	0	0	0.0
Kootenai Valley	1992	0	0	0.0	14	16	6.4	0	0	0.0
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Maggie Creek	1992	0	0	0.0	14	17	6.8	0	0	0.0
	1991	0	0	0.0	78	287	114.8	0	0	0.0
Mica	1992	2	15	0.4	509	1,666	666.4	0	0	0.0
	1991	0	0	0.0	615	1,756	702.4	0	0	0.0
Nez Perce	1992	0	0	0.0	280	349	139.6	1,329	696	278.4
	1991	0	0	0.0	374	560	224.0	1,171	1,514	605.6
Pend Oreille	1992	0	0	0.0	32	86	34.4	0	0	0.0
	1991	0	0	0.0	46	154	61.6	0	0	0.0
Priest Lake	1992	0	0	0.0	6	16	6.4	0	0	0.0
	1991	0	0	0.0	18	42	16.8	0	0	0.0
West St. Joe	1992	0	0	0.0	170	899	359.6	0	0	0.0
	1991	2	5	0.1	159	849	339.6	0	0	0.0
Coeur d'Alene IR	1992	0	0	0.0	78	335	134.0	0	0	0.0
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Nez Perce IR	1992	0	0	0.0	26	122	48.8	0	0	0.0
	1991	0	0	0.0	74	270	108.0	0	0	0.0
North Idaho Totals	1992	2	15	0.4	1,734	4,819	1,927.6	1,576	951	380.4
	1991	15	80	2.0	1,994	6,411	2,564.4	1,186	1,531	612.4

Table 2b. Idaho Statewide summary; annual bark beetle mortality by reporting area: South Idaho

		Pine Engraver Beetle Estimated Mortality			Western Pine Beetle Estimated Mortality			Spruce Beetle Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Boise	1992	606	585	5.9	5,455	5,263	2,894.7	571	141	67.4
	1991	740	720	7.2	6,660	6,480	3,564.0	0	0	0.0
Caribou	1992	0	0	0.0	0	0	0.0	0	0	0.0
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Challis	1992	0	0	0.0	0	0	0.0	0	0	0.0
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Payette	1992	220	277	2.8	1,979	2,493	1,371.2	31,155	31,719	15,161.7
	1991	210	100	1.0	1,890	900	495.0	36,100	23,800	11,376.4
Salmon	1992	0	0	0.0	0	0	0.0	60	84	40.2
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Sawtooth	1992	58	25	0.3	518	224	123.2	10	14	6.7
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Targhee	1992	0	0	0.0	0	0	0.0	20	28	13.4
	1991	0	0	0.0	0	0	0.0	0	0	0.0
South Idaho Totals	1992	884	887	9.0	7,952	7,980	4,389.1	31,816	31,986	15,289.4
	1991	950	820	8.2	8,550	7,380	4,059.0	36,100	23,800	11,376.4
State Totals	1992	886	902	9.4	9,686	12,799	6,316.7	33,392	32,937	15,669.8
	1991	965	900	10.2	10,470	13,521	6,515.4	37,286	25,331	11,988.8

Northern Idaho Pine and Spruce Mortality



Southern Idaho Pine and Spruce Mortality

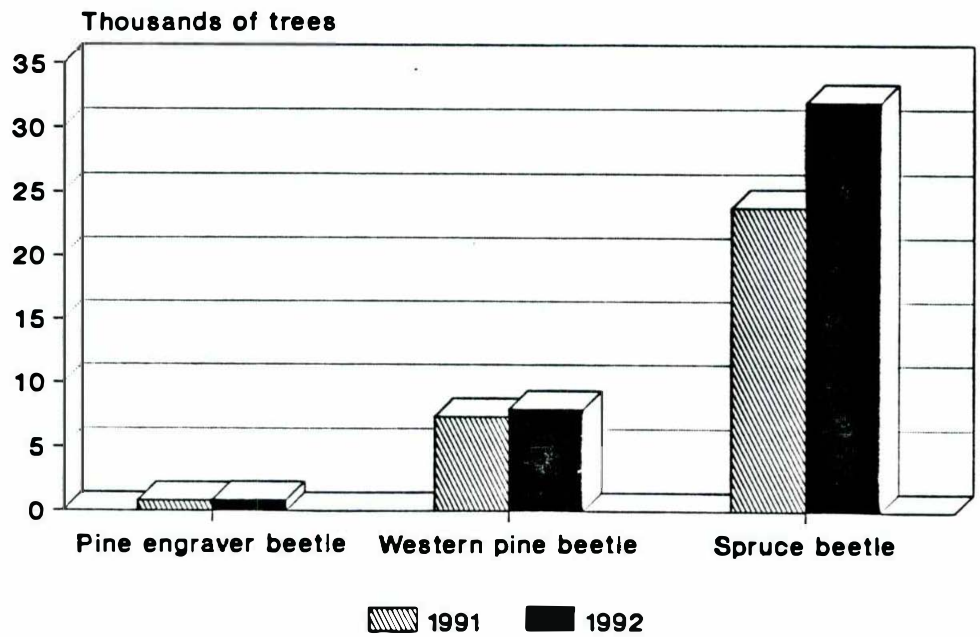


Figure 2. Northern and Southern Idaho
Pine and Spruce Mortality
by Bark Beetle Species 1991 - 1992

Table 3. Estimated spruce beetle caused mortality, 1985 - 1992

		ESTIMATED MORTALITY		
Forest and adjacent lands	**YEAR**	**Acres Infested**	**Trees**	**MBF Volume**
Boise	1985	55	84	33.6
	1986	--	1,095	438.0
	1987	607	669	319.8
	1988	155	254	121.4
	1989	175	227	108.5
	1990	100	40	19.1
	1991	0	0	0.0
	1992	571	141	67.4
Payette	1985	3,881	13,775	5,510.0
	1986	--	12,600	5,040.0
	1987	13,002	15,873	7,587.3
	1988	36,364	44,756	21,393.4
	1989	26,451	32,108	15,347.6
	1990	152,810	185,460	88,649.9
	1991	36,100	23,800	11,376.4
	1992	31,155	31,719	15,161.7
Totals	**1985-1992**	**301,426**	**362,601**	**171,174.1**

DOUGLAS-FIR BEETLE

In northern Idaho, the area infested by Douglas-fir beetle increased markedly, from approximately 5,300 acres in 1991 to more than 14,800 acres in 1992. An estimated 29,600 trees (10.4 MBF) were killed in 1992 compared to 12,300 trees (4.3 MMBF) in 1991 (Table 4a, Figure 3). These numbers will likely increase in 1993 due to the availability of extensive blowdown that occurred in the fall of 1991. Beetles that attacked that slash in the spring of 1992 will be ready to emerge and attack new trees in 1993.

The Nez Perce NF had the greatest beetle mortality with approximately 8,500 trees killed in 1992, an increase of nearly 4,900 from 1991. The major activity is concentrated along the middle fork of the Clearwater River just west of Lowell. Activity on the other national forests and adjacent state and private lands of north Idaho also increased substantially.

Mortality increased in southern Idaho to 105,500 trees (Table 4b, Figure 3); the largest infestations were located on the Boise, Payette, and Sawtooth National Forests; smaller infestations were located on the Challis, Salmon, and Targhee National Forests.

FIR ENGRAVER

Fir engraver beetle populations stayed at a static level in 1992, with a nearly identical number of trees being killed each year (Table 4a, Figure 3). However, the number of infested acres did increase from 5,600 in 1991 to 14,000 in 1992. This may indicate a general weakening of the trees where the beetles have had an easy time finding a new host tree and are thus scattered out more than in the past.

In the Craig Mountains and the Kendrick areas, the mortality decreased substantially, while it increased on the Nez Perce and Idaho Panhandle National Forests.

Significant increases occurred in southern Idaho, where approximately 41,900 trees were killed primarily on the Boise National Forest.(Table 4b, Figure 3).

WESTERN BALSAM BARK BEETLE

In northern Idaho, western balsam bark beetle activityincreased dramatically in 1992. The number of subalpine fir killed increased from over 800 in 1991 to nearly 4,400 in 1992 (Table 4a, Figure 3). Most of the increases occurred on the Bonners Ferry RD, IPNF's, North Fork and Powell RD's, Clearwater NF, and the Red River and Elk City RD's, Nez Perce NF. Examinations in high elevation stands in the Selkirk Mountains, Bonners Ferry RD found subalpine fir attacked by western balsam bark beetle were older, in dense stands, and many had armillaria root disease. Many high elevation stands are in similar condition and mortality is expected to continue.

A total of 80,400 subalpine fir were killed in southern Idaho on the Boise, Challis, Sawtooth and Targhee NF's. Large amounts of mortality in subalpine fir are still occurring in southeastern Idaho. This mortality is attributed to the western balsam bark beetle in the tables (Table 4b, Figure 3). However, ground checking in the Cottonwood and Blackfoot Mountain blocks of state land did not reveal this beetle to be the cause of the death. The principle pests discovered were two bark beetles, Pityokteines lasiocarpi (Swaine) and P. minutus (Swaine), Annosus root disease, Cytospera canker and fir broom rust.

Table 4a. Idaho Statewide summary; annual bark beetle mortality by reporting area: North Idaho

		Douglas-Fir Beetle Estimated Mortality			Fir Engraver Beetle Estimated Mortality			Western Balsam Bark Beetle Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Bitterroot	1992	1,032	4,443	1,555.0	0	0	0.0	2	2	0.2
	1991	1,960	1,815	635.3	6	12	2.4	18	64	7.0
Cataldo	1992	69	210	73.5	83	187	37.4	6	8	0.9
	1991	34	99	34.6	41	137	27.4	2	10	1.1
Clearwater	1992	2,215	5,049	1,767.1	306	458	91.6	606	835	91.8
	1991	746	2,919	1,021.6	360	982	196.4	1	2	0.2
CTPTA	1992	196	566	198.1	292	987	197.4	0	0	0.0
	1991	136	481	168.3	214	679	135.8	2	10	1.1
Craig Mtns.	1992	473	705	246.7	857	1,813	362.6	0	0	0.0
	1991	52	210	73.5	2,485	6,542	1,308.4	0	0	0.0
IPNFs	1992	2,691	5,249	1,837.1	2,644	2,594	518.8	1916	2335	256.9
	1991	847	2,666	933.1	290	463	92.6	57	177	19.5
Kendricks	1992	537	2,555	894.3	190	690	138.0	0	0	0.0
	1991	26	65	22.8	609	1,875	375.0	0	0	0.0
Kootenai Valley	1992	12	10	3.5	23	13	2.6	0	0	0.0
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Maggie Creek	1992	42	104	36.4	996	571	114.2	32	65	7.2
	1991	38	120	42.0	87	338	67.6	0	0	0.0
Mica	1992	51	190	66.5	495	669	133.8	0	0	0.0
	1991	29	105	36.8	178	405	81.0	0	0	0.0
Nez Perce	1992	6,967	8,468	2,963.8	7,465	4,710	942.0	795	845	93.0
	1991	1,368	3,580	1,253.0	1,089	2,343	468.6	8	20	2.2
Pend Oreille	1992	62	165	57.7	28	62	12.4	8	32	3.5
	1991	40	104	36.4	16	53	10.6	2	25	2.8
Priest Lake	1992	10	45	15.7	24	55	11.0	50	270	29.7
	1991	10	33	11.5	0	0	0.0	118	520	57.2
West St. Joe	1992	226	875	306.3	218	895	179.0	2	5	0.6
	1991	42	125	33.8	254	925	185.0	0	0	0.0
Coeur d'Alene IR	1992	8	40	14.0	34	130	26.0	0	0	0.0
	1991	0	0	0.0	0	0	0.0	0	0	0.0
Nez Perce IR	1992	229	921	322.3	338	964	192.8	0	0	0.0
	1991	0	0	0.0	0	0	0.0	0	0	0.0
North Idaho Totals	1992	14,820	29,595	10,358.0	13,993	14,798	2,959.6	3,417	4,397	483.8
	1991	5,328	12,322	4,302.7	5,629	14,754	2,950.8	208	828	91.1

Table 4b. Idaho Statewide summary; annual bark beetle mortality by reporting area: South Idaho

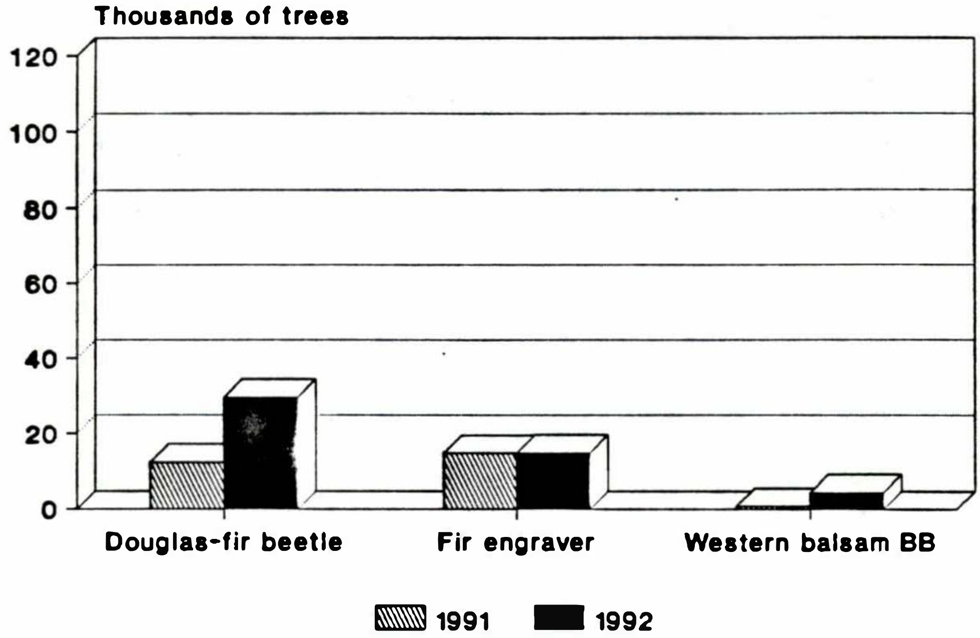
		Douglas-Fir Beetle Estimated Mortality			Fir Engraver Beetle Estimated Mortality			Western Balsam Bark Beetle Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Boise	1992	51,602	34,853	4,949.1	23,907	41,869	7,955.1	4,511	3,541	389.5
	1991	26,500	27,900	3,961.8	13,300	7,600	1,444.0	9,000	6,200	682.0
Caribou	1992	4,974	8,044	1,142.2	5	5	0.9	20	50	5.5
	1991	1,900	2,400	340.8	0	0	0.0	39,900	52,500	5,775.0
Challis	1992	560	906	128.7	0	0	0.0	2,050	2,361	259.7
	1991	800	1,000	142.0	0	0	0.0	300	400	44.0
Payette	1992	14,839	15,781	2,240.9	35	35	6.7	0	0	0.0
	1991	19,200	16,000	2,272.0	5,100	5,100	969.0	0	0	0.0
Salmon	1992	6,936	8,703	1,235.8	0	0	0.0	480	430	47.3
	1991	7,300	7,600	1,079.2	0	0	0.0	700	700	77.0
Sawtooth	1992	14,242	31,305	4,445.3	0	0	0.0	17,040	25,229	2,775.2
	1991	8,200	10,200	1,448.4	0	0	0.0	17,200	17,700	1,947.0
Targhee	1992	6,532	5,900	837.8	0	0	0.0	34,545	48,783	5,366.1
	1991	13,800	15,300	2,172.6	0	0	0.0	19,800	40,600	4,466.0
South Idaho Totals	1992	99,685	105,492	14,979.8	23,947	41,909	7,962.7	58,646	80,394	8,843.3
	1991	77,700	80,400	11,416.8	18,400	12,700	2,413.0	86,900	118,100	12,991.0
State Totals	1992	114,505	135,087	25,337.8	37,940	56,707	10,922.3	62,063	84,791	9,327.1
	1991	83,028	92,722	15,719.5	24,029	27,454	5,363.8	87,108	118,928	13,082.1

RED TURPENTINE BEETLE

Young western white pine 2-6 inches in diameter which had been pruned and excised for blister rust control were attacked by the red turpentine beetle on the Palouse RD, Clearwater NF. The beetle attacked the base of pruned trees and gallery construction followed by larval feeding girdled from 10-100% of the tree circumference. Initial observations in 3 plantations surveyed in 1992 found infestation levels ranged from 1-41% and mortality associated with red turpentine beetle attacks was 10% in one plantation. A special project was initiated to monitor the significance of this problem.

In southern Idaho, mortality from this beetle occurred on fire scarred ponderosa pine throughout burned areas.

Northern Idaho Fir Mortality



Southern Idaho Fir Mortality

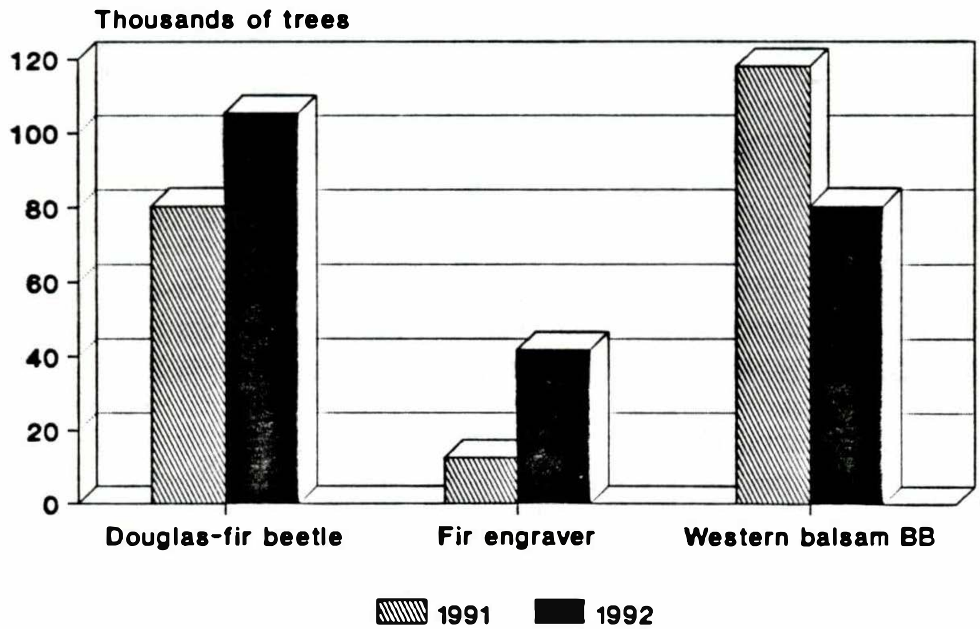


Figure 3. Northern and Southern Idaho Fir Mortality by Bark Beetle Species 1991 - 1992

DEFOLIATORS

DOUGLAS-FIR TUSSOCK MOTH

There continues to be no visible defoliation due to the Douglas-fir tussock moth in the forested areas of northern Idaho. The pheromone trapping detection surveys were conducted and trap counts were in general, still low (Table 6, Figure 5), with a slight increase in the overall trap catches. For the first time in five years every trap site caught at least one moth in 1992. Larval sampling continues to be conducted at the high pheromone trap sites as part of the early warning system. Larval populations from lower crown sampling, taken in the spring, were low at most sample sites, with a slight increase in overall larval populations. The most noticeable increase in trap catches and larval populations occurred in the Skyline Drive area, just north of Potlatch, Idaho.

In southern Idaho, 418,000 acres of defoliation were detected (Table 5a) on the Boise National Forest and contiguous areas of the Sawtooth NF's, on the Payette NF's, throughout the Owyhee Mountains, and along the Big Wood River drainage near Ketchum.

Most of the defoliation was classified as moderate to heavy with significant mortality occurring in areas with three consecutive years of heavy defoliation.

WESTERN SPRUCE BUDWORM

In northern Idaho, defoliation on the Salmon RD, Nez Perce NF increased in both acreage and intensity. Defoliated acres expanded from about 12,000 acres in 1991 to nearly 58,000 acres in 1992 (Table 5b Figure 4). More than half of the defoliated acres were classified as "heavy" compared to most acreage classified as "light" in 1991. However, an average of only 0.75 egg masses per square meter of foliage from 16 plots were found in 1992 compared with 4.42 in 1991. Likewise, pheromone trap catches declined from 191 adults caught in 16 traps in 1991 to only 23 caught in 1992.

The plots were in areas of heavy defoliation where the majority of the new growth on grand fir, Douglas-fir, and spruce had been consumed. Even non-host species such as ponderosa pine showed evidence of budworm feeding. Populations in these areas appear to be in a state of decline due to starvation and natural enemies. Results from our trapping in 1993 should provide us with a more definitive trend. If defoliation continues, topkill and mortality is expected. Permanent plots have been established in these areas to quantify the affect of budworm defoliation on the structure and function of ecosystems.

Populations in the fringes of the infested area, and in areas of lighter defoliation, are increasing. Areas of defoliation are expected to expand in 1993. However, the intensity in specific areas may actually decrease.

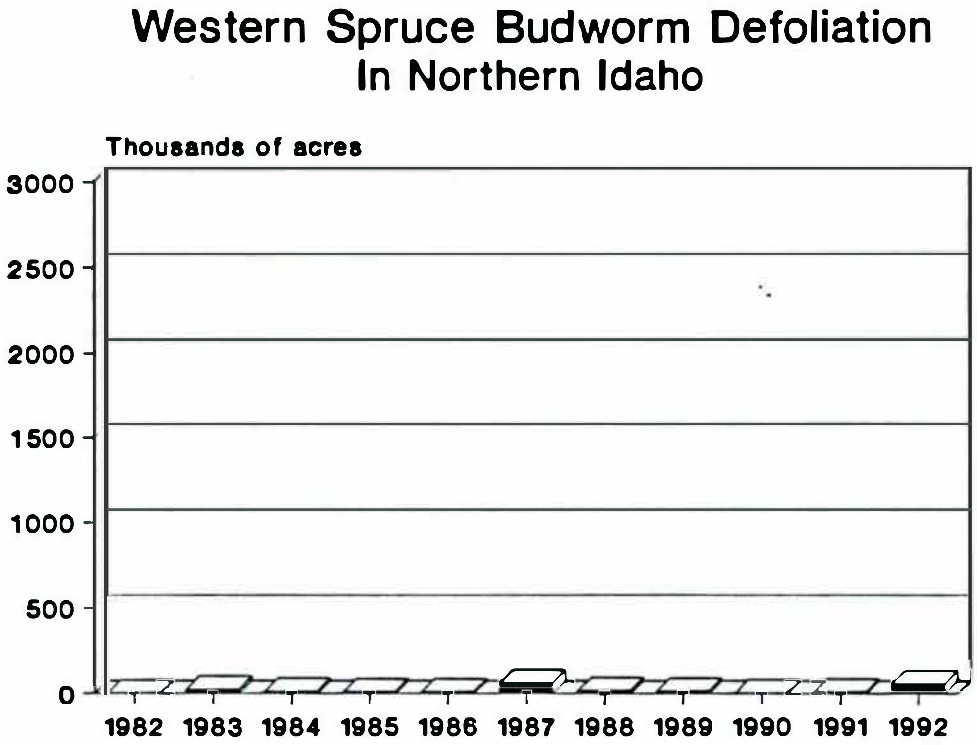
In southern Idaho, aerially visible defoliation decreased from 49,300 acres in 1991 to 32,000 acres in 1992 (Table 5b, Figure 4). Most defoliation is located on the Salmon NF's while a smaller outbreak is located on the Challis NF. Ground observations indicate that western spruce budworm activity, undetectable aerially, is extensive throughout the host type on the Salmon NF and within areas defoliated by Douglas-fir tussock moth on the Payette NF.

Table 5a. Acres of DOUGLAS-FIR TUSSOCK MOTH defoliation as determined by aerial surveys

		Defoliation Intensity				
Forest and adjacent lands	Year	Light	Moderate	Heavy	Total	Change
Boise	1992 1991	28,700 59,629	47,900 47,080	154,500 102,628	231,100 209,337	+27,763
Payette	1992 1991	19,400 679	22,700 970	6400 16,771	48,500 18,420	+30,080
Sawtooth	1992 1991	19,000 14,840	15,200 16,234	89,200 38,183	123,400 69,257	+54,143
Owyhee Mtns.	1992 1991	0 0	0 0	15,000 15,000	15,000 15,000	0
Total	1992 1991	67,100 75,148	85,800 64,284	265,100 172,582	418,000 312,014	+105,986

Table 5b. Acres of WESTERN SPRUCE BUDWORM defoliation as determined by aerial surveys.

		Defoliation Intensity				
Forest and adjacent lands	Year	Light	Moderate	Heavy	Total	Change
Challis	1992 1991	3,300 2,200	600 0	0 0	3,900 2,200	+1,700
Nez Perce	1992 1991	26,967 11,127	1,330 1,072	29,513 0	57,810 12,199	+4,511
Salmon	1992 1991	18,900 44,300	7,600 1,900	1,600 0	28,100 46,200	-18,100
Targhee	1992 1991	0 900	0 0	0 0	0 900	-900
Total	1992 1991	49,167 58,527	9,530 2,972	31,113 0	89,810 61,499	+28,311



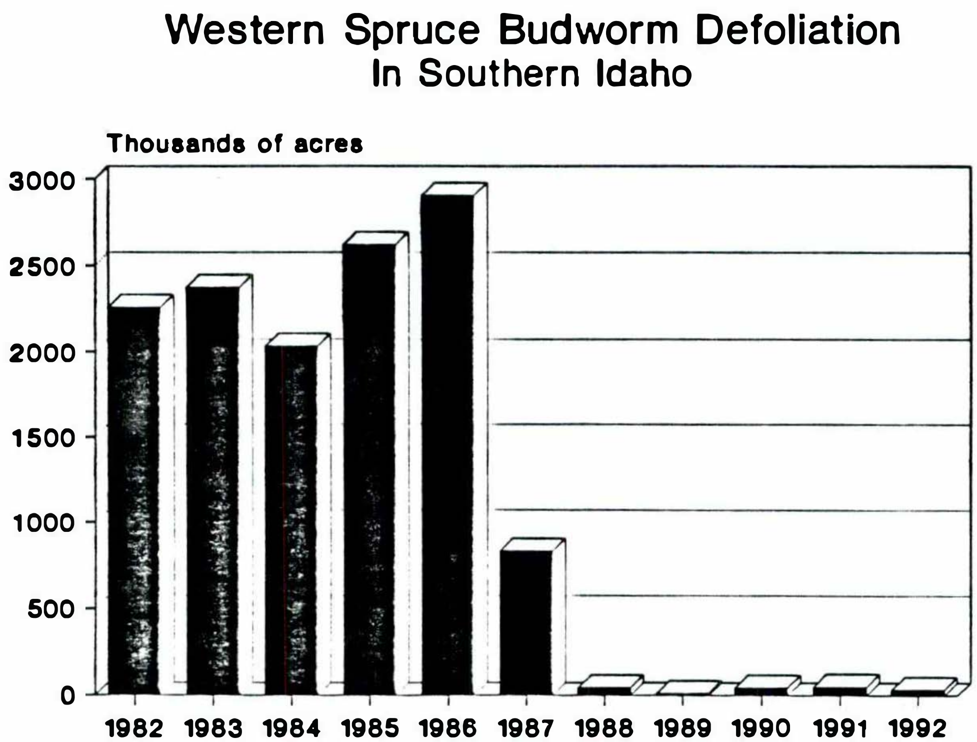


Figure 4. Acres of Western Spruce Budworm as determined by Aerial Surveys in Northern and Southern Idaho 1982 - 1992

Table 6. Means of average moth catch per 5 pheromone trap/sample plots in Idaho, 1992-1982

AREA	Number of 1992 sample plots	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982
STATE AND PRIVATE												
Coeur d'Alene	5	0.1	0.0	•	•	•	•	•	•	•	•	•
Coeur d'Alene	5	0.1	0.1	7.2	0.0	0.0	0.2	8.1	9.2	4.7	3.6	1.5
Plummer-Moscow	13	0.7	0.1	0.1	0.0	0.1	1.3	25.6	59.9	18.8	13.8	9.3
Plummer-Moscow	9	0.5	0.1	0.1	0.0	0.0	0.3	15.2	43.3	7.0	3.3	2.5
Plummer-Moscow	4	0.5	0.0	0.1	0.0	0.0	0.5	14.6	32.6	9.0	4.3	•
Plummer-Moscow	1	4.0	0.0	0.0	0.0	0.0	1.0	42.8	68.4	36.4	•	•
Plummer-Moscow	1	0.2	0.0	0.0	0.0	0.0	3.8	49.7	76.0	•	•	•
Plummer-Moscow	3	1.6	0.1	0.1	0.0	0.2	9.0	80.5	•	•	•	•
Plummer-Moscow	8	0.1	0.1	0.2	0.0	0.1	2.2	•	•	•	•	•
Craig Mountain	8	0.5	0.0	0.2	0.0	0.0	0.1	3.5	0.4	0.6	0.5	0.5
NEZ PERCE NF												
Selway RD	5	0.1	0.0	0.4	0.1	0.2	0.0	0.1	0.0	0.1	0.1	0.6
Slate Ck. RD	5	0.7	2.5	0.1	0.0	0.0	0.0	0.9	0.3	0.7	1.9	2.1
CLEARWATER NF												
Lochsa RD	2	0.2	1.2	0.0	0.2	0.0	0.0	0.3	0.0	0.0	0.0	0.2
Canyon RD	5	0.1	0.3	0.2	0.0	0.0	0.0	1.7	0.9	•	•	7.4
Pierce RD	5	0.3	0.6	0.3	0.0	0.1	0.1	4.0	0.6	0.1	0.1	3.0
BOISE NF												
Mountain Home RD	5	32.2	68.9	5.3	0.2	0.6	1.4	1.2	0.0	0.4	21.7	0.3
Boise RD	6	23.5	59.6	65.6	•	•	•	•	•	•	•	•
Idaho City RD	3	0.6	27.2	•	•	•	•	•	•	•	•	•
Cascade RD	5	0.4	0.7	31.6	0.0	0.2	0.2	1.2	1.0	0.0	20.0	0.3
Lowman RD	11	1.8	20.0	•	•	•	•	•	•	•	•	•
Emmett RD	10	1.2	19.7	•	•	•	•	•	•	•	•	•
PAYETTE NF												
Council RD	12	2.8	6.6	23.2	0.7	1.9	7.4	21.2	5.1	6.7	38.2	43.3
Weiser RD	12	2.4	21.4	67.0	0.8	0.7	5.2	15.2	4.1	8.1	42.1	43.3
New Meadows RD	10	1.6	8.8	•	•	•	•	•	•	•	•	•
McCall Rd	5	0.8	0.7	•	•	•	•	•	•	•	•	•
SALMON NF												
Northfork RD	•	•	•	0.4	0.6	21.3	2.9	6.6	•	1.9	38.7	11.4
SAWTOOTH NF												
Fairfield RD	4	35.3	70.5	80.3	16.5	3.3	13.3	19.7	0.0	6.3	20.3	5.2
OTHER												
Owybee Mountains	4	51.1	76.1	75.5	12.8	15.8	7.8	9.4	0.6	10.8	•	•
Sharps Canyon	1	18.8	•	53.2	9.2	36.4	8.4	22.6	5.2	1.3	41.2	16.2
Pine Rdg-Lost Lake	1	5.0	25.0	•	•	•	•	•	•	•	•	•

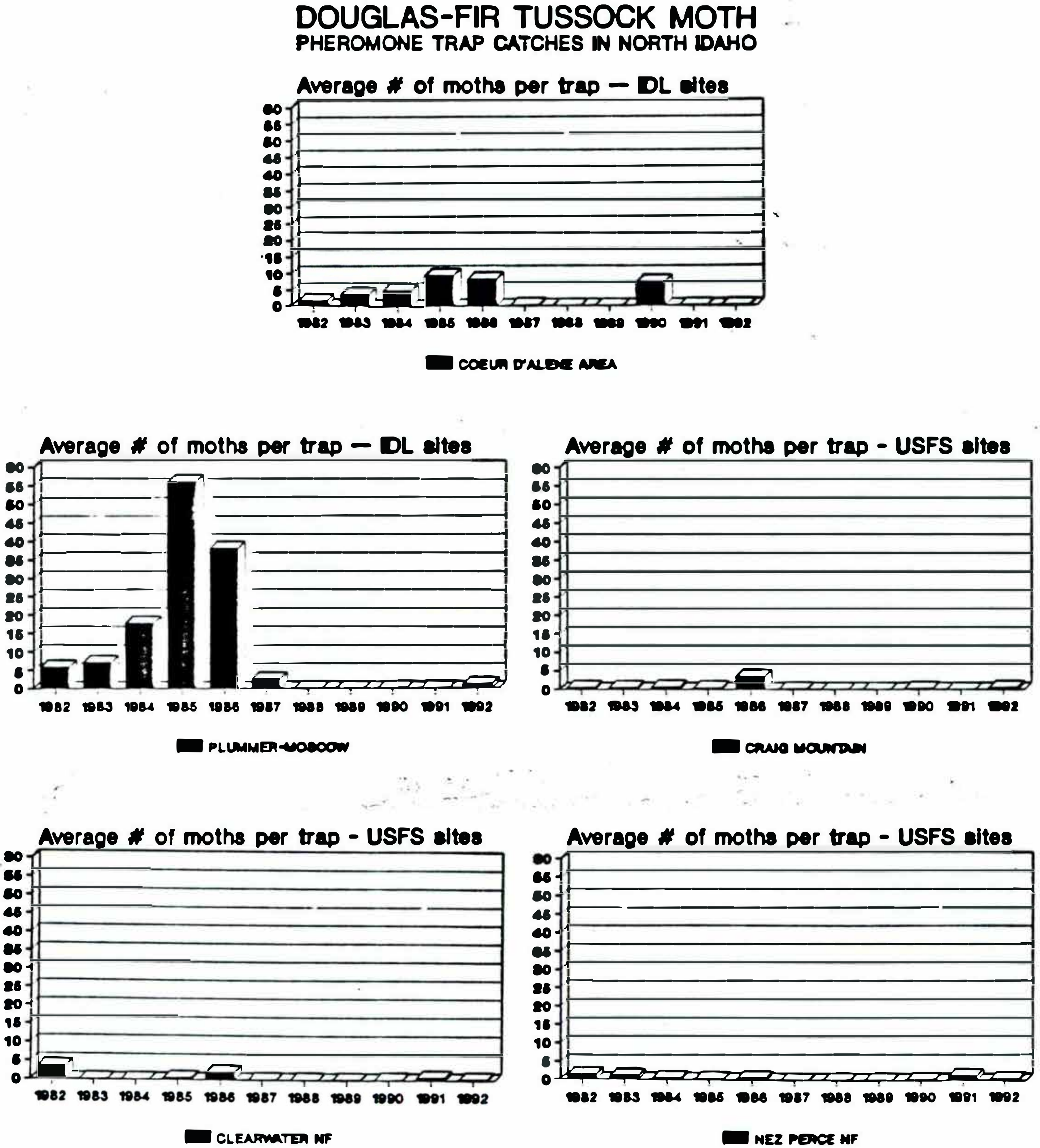


Figure 5. USFS and IDL Douglas-fir Tussock Moth Trap Catches in Northern Idaho 1982 - 1992

DOUGLAS-FIR TUSSOCK MOTH

PHEROMONE TRAP CATCHES IN SOUTH IDAHO

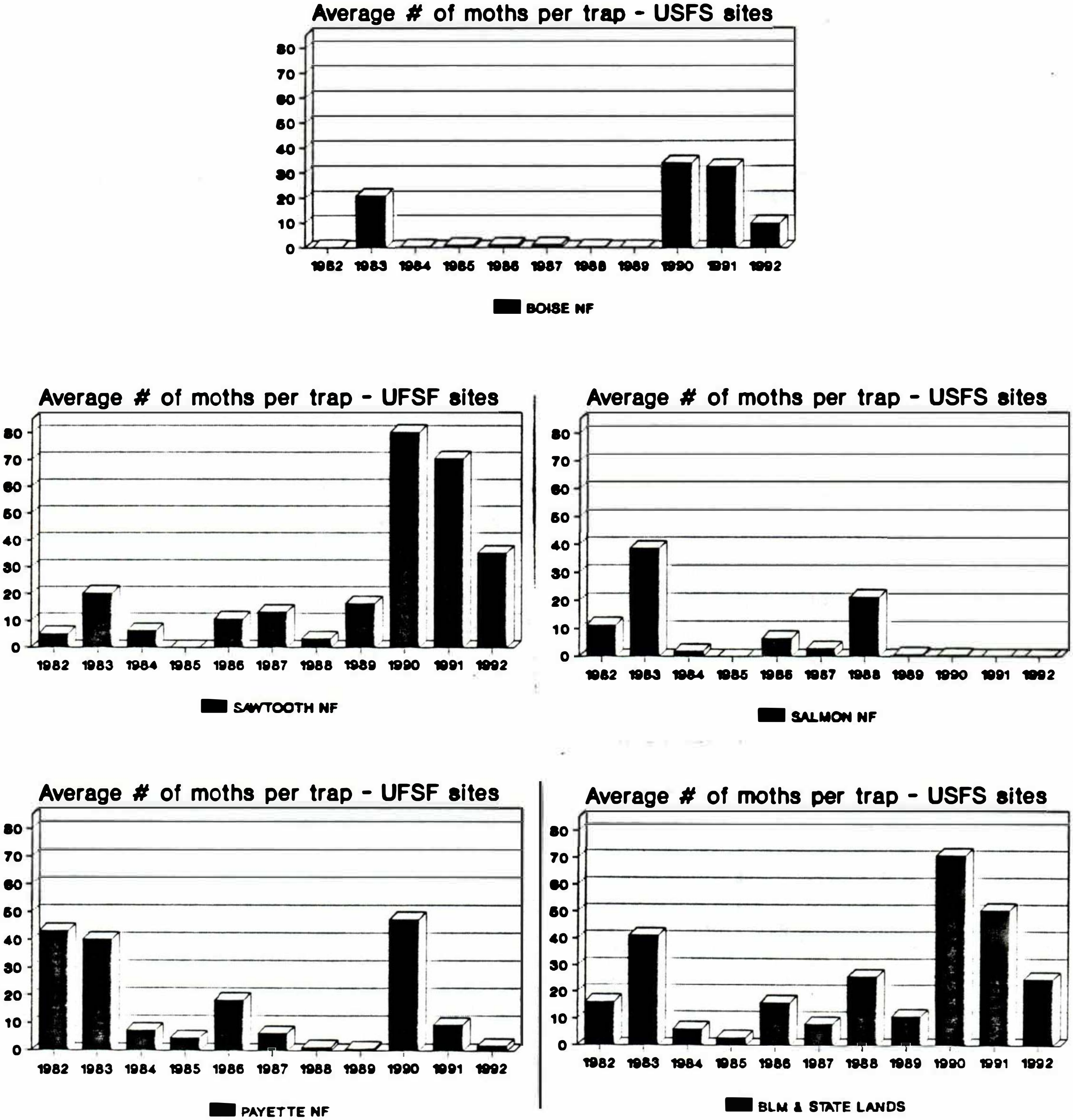


Figure 6. USFS
Douglas-fir Tussock Moth Trap Catches
in Southern Idaho 1982 -1992

GYPSY MOTH

The Idaho gypsy moth detection survey program continues to systematically sample all areas of the state to detect any introductions of gypsy moths. The program systematically traps all populated areas of the state over a three year period with areas of higher risk trapped each year or, in some cases every other year. The survey areas will continue to expand as the rural/urban interface develops and more people move into the rural areas of the state.

Previous infestations: Eradication of previous infestations of gypsy moths in Sandpoint, Bonner County and in Coeur d'Alene, Kootenai County, has now been confirmed for three years. No moths were caught in the areas of concern in 1990, 1991 or 1992 after treatments in 1989 and 1990 with Bacillus thuringiensis.

Delimitation trapping: Delimitation trapping at 36 traps per square mile was done in the areas surrounding four 1991 detection catch sites. One gypsy moth was caught in a 1992 delimitation trap at Pinehurst, a few blocks from the site of the 1991 catch. The 1991 traps caught four moths in widely separated areas of the state, one at Pinehurst, Shoshone County 30 miles east of Coeur d'Alene, one at Moscow, Latah County in north central Idaho, one at Wendell, Gooding County in southern Idaho and one near the eastern edge of the state at Rigby, Jefferson County. We believe these catches to be incidental.

Detection trapping: The Idaho Department of Lands, the Idaho Department of Agriculture and the U.S. Forest Service Regions 1 and 4, with participation from the Animal and Plant Health Inspection Service, cooperatively placed approximately 5000 pheromone baited traps in the urban and rural areas of the state in 1992. The target density for these detection traps is 4 traps per square mile. Added emphasis is given to cities, towns and rural areas where a sufficient population influx occurred to generate an increased risk of introduction of gypsy moths. Tracking of those moving into Idaho from gypsy moth infested states is provided by the Idaho Department of Transportation in a report which shows their destination. The report, derived from applications for vehicle title transfers, documents that approximately 1200 individuals or families move to Idaho each month from states where gypsy moth infestations are common.

Three gypsy moths were caught in Idaho in 1992. Again all of these moths were single catches in widely scattered locations. As mentioned, one moth was caught at Pinehurst, Shoshone County in a delimitation trap. The others were caught in Filer, Twin Falls County and in Shelley, Bingham County in detection traps (see map). These areas will be intensively trapped in 1993.

Regularly scheduled detection trapping will continue through out the state in 1993. Additional high risk areas to be trapped will be determined using the above mentioned movein report.

State Advisory Committee: An advisory committee, composed of representatives from the above mentioned agencies and the University of Idaho, provides guidelines for the gypsy moth program in Idaho.

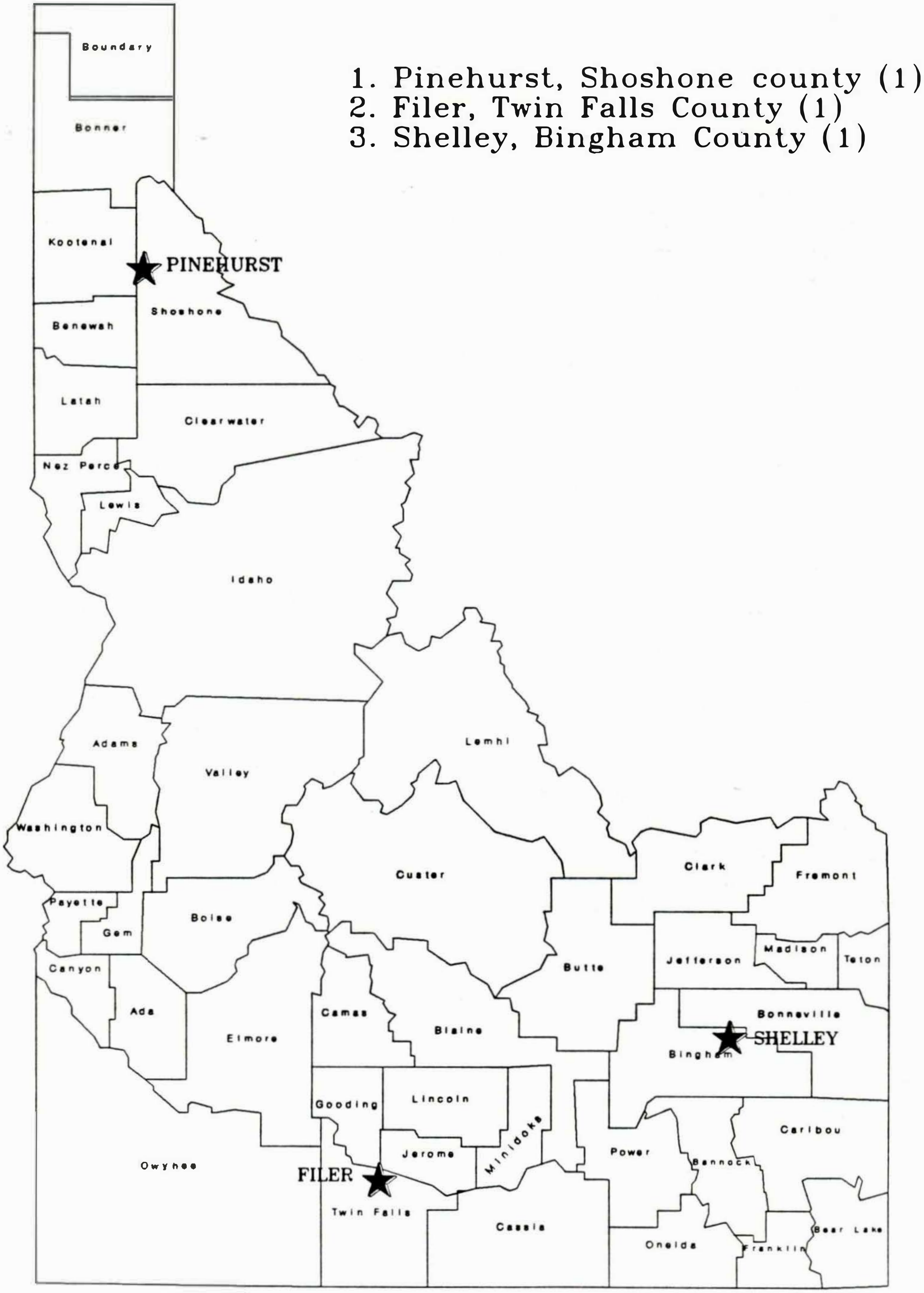


Figure 7. State of Idaho
1992 Gypsy Moth Catch Sites

OTHER INSECTS

BALSAM WOOLLY ADELGID

Balsam woolly adelgid populations declined considerably in 1991 but had a dramatic increase in 1992 and continue to pose a threat to true firs throughout northern Idaho. During the winter of 90/91, the severe weather conditions may have contributed to the population decline reported last year. With the extremely mild winter of 91/92, tree mortality is once again on the increase in 1992.

Aerial surveys detected over 17,700 acres in 1992 as compared to 10,000 acres in 1991 of dead and fading subalpine fir. Numerous other areas have infested trees that are not yet showing symptoms from the air. Most of the damage is still occurring on the St Joe, Clearwater and Nez Perce NF's and on adjacent state and private lands. Considerable mortality is still occurring on private lands in the Craig Mountains south of Lewiston and in the Joseph Plains area south of the Salmon River. Tree mortality continues to be confined to subalpine fir, although bole infestations are still occurring on grand fir of all ages. The heavy gouting, then killing of true fir regeneration located adjacent to infested subalpine fir stands, has taken a heavy toll. In many of the areas this insect has killed 75% of the true fir regeneration.

WESTERN PINE SHOOT BORER

Tensed and Lone Mountain ponderosa pine test plantations were treated for the final year in the 5-year plan using mating disruption with artificial pheromone, to reduce growth loss caused by shoot borer attacks.

CRANBERRY GIRDLER MOTH

Cranberry girdler moths were caught in pheromone traps at the Coeur d'Alene nursery from May 14 through September 18. Peak flight occurred from June 26-July 2 when 639 moths were caught compared to 929 moths caught during the peak in 1991. This year's peak flight occurred 3 weeks earlier than 1991. The nursery beds were sprayed with one application of Diazinon, aimed at adults, on July 2 & 7. One application of Dursban, targeting larvae in the soil, was applied on August. 5,6, and 10. During the November 1992 lifting process, a total of 24,571 2-0 Douglas-fir and western larch seedlings were examined for damage. Out of the 14,327 larch examined, only 2 (0.01%) were damaged by the girdler moth and 4 (0.04%) of 10,244 Douglas-fir were damaged by girdler moth. Plans for 1993 are to reduce the number of pesticide applications.

CONE AND SEED INSECTS

Seedbugs were active earlier than usual this year and were very abundant. Seedbugs were observed for the first time at the Lone Mountain and Grouse Creek white pine seed orchards and record numbers were recorded at the Coeur d'Alene orchard. They were also found in September in the Moscow seed orchard.

The Coeur d'Alene white pine seed orchard was sprayed 3 times with permethrin (Pounce) on May 8,11,12, July 14-15, and September 9,10 to control seedbugs. The orchard is surrounded by ponderosa pine trees (cones of which are host to seedbugs) that serve as a reservoir for seedbugs and immigration of the pest can be a problem even when the orchard population is controlled. A total of 509 bushels of cones were harvested yielding 170.6 pounds of seed. This record high yield (.34 lb/bu) is attributed to insect control, an increase in natural pollen, and the mild winter of 91-92. Low levels of coneworms and many pine bark adelgids were also observed in the orchard.

Cone harvest was low this year at both Lone Mountain and Grouse Creek seed orchards. Twenty-nine bushels of cones were collected at Lone Mountain yielding .89 pounds of seed (.04 lb/bu). Grouse Creek produced .5 bushels of cones yielding .16 pounds of seed (.32 lb/bu). Coneworms, adelgids, and seedbugs were observed in both orchards.

The Moscow white pine seed orchard was sprayed once with Asana in September 1992 to control seedbugs. Pheromone baited traps used to monitor the cone moth caught less than 5 moths in the spring, so no treatment was applied for them. However, it appears that the treatments should have taken place because the amount of debris, hollow and insect damaged seed was higher than normal from the Moscow cones in 1992. A large number of coneworms were seen leaving drying cones in the drying sheds. These were fed upon by many starlings as they moved into the open seeking access to the ground from the sheds.

RUSTY TUSSOCK MOTH

Outbreak populations of the rusty tussock moth were found in many areas of northern Idaho in 1992. High numbers of caterpillars defoliated the shrub species, especially huckleberry, in high elevation stands. At many sites the brush suffered 100% defoliation, and often the berries on the huckleberry plants had even been fed upon. At those sites where the defoliation of the brush was most intense, the caterpillars moved onto and fed on the foliage of young conifers. Visible defoliation was seen on western larch, lodgepole pine, grand fir and western white pine. There was light, but extensive defoliation of lodgepole pine on the ridge at the heads of Beaver, Fly, Mosquito, and Bluff Creeks in the St. Joe River drainage.

PINE NEEDLE SHEATH MINER

The pine needle sheath miner caused light to medium damage to stands of both lodgepole and ponderosa pine throughout northern Idaho in 1992. The typical "bent needle" damage was seen from Sandpoint on the north to the canyon of the Little Salmon River south of Riggins, on the south.

WILLOW LEAF BEETLE

High populations of an unidentified leaf beetle were reported skeletonizing willow and cottonwood on the Priest Lake RD.

FOREST DISEASES

This narrative is divided into three sections. The first section describes unusual diseases or disease problems which have changed significantly during 1992. Our most severe disease problems continue to cause widespread damage over much of the same areas every year. Rough estimates indicate that root disease mortality occurs on nearly 2 millon acres of north Idaho forests, causing losses of over 30 million cubic feet. Estimates for dwarf mistletoe indicate over 700,000 acres are infected with volume losses of over 13 million cubic feet.

The second section is a table which summarizes all disease problems observed in 1992 with brief remarks describing hosts, location and severity.

The final section of the narrative briefly describes current forest pest management projects dealing with root diseases, dwarf mistletoes, white pine blister rust, and nursery diseases.

STEM AND BRANCH DISEASES

DWARF MISTLETOES

Dwarf mistletoe management considerations are generally included in Forest plans, and emphasize management through conventional forest management practices. However, there are still some previously harvested stands that qualify for a sanitizing treatment to eliminate residual infested trees that are threatening the new regeneration. Accomplishments for 1992 are reported in Table 7.

Table 7. - Dwarf Mistletoe Accomplishments - Southern Idaho 1992

National Forest	Treated Acres
Boise	600
Caribou	155
Challis	120
Payette	360
Salmon	131
Sawtooth	190
Targhee	155
Total	1711

ROOT DISEASES

Root diseases continue to be the primary disease concern throughout northern Idaho forests and are the subject of several studies. Please refer to the project summaries in the following pages for the current status of these projects.

FOLIAGE DISEASES

In spite of an early warm, relatively dry spring in northern Idaho, needle diseases in lodgepole pine were quite spectacular, causing widespread areas to redden and prompting considerable public concern. A special aerial survey was conducted over portions of the Lolo, Clearwater and IPNF NF's in June. Although only portions of the lodgepole pine type were flown, this survey mapped in 114,000 acres with light infection, over 308,000 acres moderately infected and nearly 80,000 acres heavily infected by lodgepole pine needlecast. This widespread outbreak was probably the result of the prolonged moist spring of 1991. Since the spring of 1992 was much drier, we might anticipate considerably less damage the spring of 1993. However, infection levels were so high this year, that only a few days of high moisture might be enough to prolong this outbreak into 1993.

Diplodia (Sphaeropsis) blight of ponderosa pine continues to cause widespread dieback of foliage and small branches throughout much of northern Idaho. Infection intensities vary widely across this area and from tree to tree in any particular location.

Other needle diseases were not as widespread, with only sporadic outbreaks observed.

VASCULAR WILTS

Since detecting Dutch Elm Diseases for the first time in Lewiston on a single tree in 1991, no new infections have been found.

The city of Boise continues to battle this disease, and removed 40 infected and 40-50 symptomatic trees in 1992. The total population is still nearly 1600 elms, and a $9,000 injection program will used to help minimize future losses in several high-risk areas.

Nine infected American elm trees were removed in Moscow; six by the University of Idaho and 3 in town. About 30 city trees are currently included in the city's injection treatment plan.

ABIOTIC DAMAGE

Unusual weather patterns or rapid changes in weather may result in "abiotic" damage. Damage can be widespread or very localized depending on the severity of the weather problem.

Sporadic mortality of young lodgepole pine in northern Idaho was observed during the spring. This was most common along roadsides and in areas of dense lodgepole pine regeneration, where occasional trees would be dead. After examining trees from several areas, it appears that the trees had probably been weakened by the unusually dry spring weather and were being attacked by wood borers. Some also had serious needle cast or western gall rust infections.

A late spring frost killed newly emerging foliage and blossoms on many ornamental and fruit trees in north Idaho. Late spring frosts also killed emerging foliage on larch in the Payette NF.

NURSERY AND TREE IMPROVEMENT DISEASES

SPRUCE MOTTLED NEEDLECAST

Several blue spruce trees from young plantations near Sandpoint were severely infected with Rhizospheria kalkhoffi which caused extensive foliar discoloration and pre-mature needle loss.

PYTHIUM ROOT DISEASE

Pythium root disease was common on aspen seedlings grown at the Clifty View Nursery in Bonners Ferry. The disease caused root system decay and most damage was in portions of seedbeds which were poorly drained.

LEAF NECROSIS OF LILAC

Species of Alternaria and Phyllosticta caused leaf necrosis of lilac seedlings from the Clifty View Nursery in Bonners Ferry. Damage was restricted to certain portions of seedbeds.

WHITE PINE NEEDLECAST

Plantations of western white pine at the Lone Mountain Tree Improvement Area were affected with Lophodermium and Leptomelanconium, fungi which caused needle necrosis and pre-mature needle loss.

GREY MOLD ON LARCH

Botrytis blight occurred at higher than normal levels on container-grown western larch seedlings at the USDA Forest Service Nursery in Coeur d'Alene. Some affected seedlings were suspected by growers to be root diseased (caused by Fusarium); however, the major problem was B. cinerea.

STATUS OF CHRONIC DISEASE PROBLEMS

DISEASE	HOST	LOCATION/REMARKS
STEM & BRANCH DISEASES		
Aspen trunk rot	Aspen	Especially common in older aspen stands in southern Idaho
Atropellis canker	Lodgepole pine	Found in pockets in pole sized stands causing defect, topkill, and some mortality.
Comandra blister rust	lodgepole pine/ponerosa pine	Most common in SE Idaho; infrequent but may be locally severe.
Cytospora canker	True firs	Increased levels of symptoms, considerable branch flagging, and top-killing in localized areas. Frequently associated with western balsam bark beetle in southern Idaho
Diplodia blight (Sphaeropsis blight)	Ponderosa pine	Is causing widespread branch dieback in many Idaho areas; severity continues to increase in northern Idaho.
Dwarf misletoe	Douglas-fir, western larch, lodgepole and ponderosa pine	Widespread and damaging throughout the state; see Table 7., for summary of suppression projects.
Indian paint fungus (Rusty-red stringy rot)	True firs, hemlock	Causes 90% of decay in these species throughout the state; especially common as age increases beyond 60 years.
Pinyon blister rust	Pinyon pine	Observed in the Raft River Mountains on the Sawtooth NF.
Red ring rot	Western larch, true firs, Douglas-fir, pines, spruce	Can cause serious decay problems in mature conifers.
Stalactiform blister rust	Lodgepole pine	Heavy infection has been observed in localized areas of the Boise, Payette, Sawtooth, and Targhee NF's.
Western gall rust	Lodgepole and ponderosa pine	Occurs throughout the host range; with localized areas of heavy infection levels are highly variable.
White pine blister rust	Western white pine, limber pine, whitebark pine	Continues to be a major mortality factor in natural regeneration; is becoming a major problem in subalpine pines.

ROOT DISEASES		
Annosus root disease	Pines, true firs, Douglas-fir, spruce	Causes mortality, root and butt rot especially in young trees near old stumps; frequently in complexes with other root diseases; may predispose trees to windthrow and/or bark beetles.
Armillaria root disease	Douglas-fir, grand fir, other conifers especially when young and improperly planted	In north Idaho, a widespread killer of all sizes of trees; a weak pathogen or in complexes in southern Idaho.
Black stain root disease	Pines, Douglas-fir	Found infrequently in Idaho; caused pinyon pine mortality in southern Idaho; usually in association with other root diseases.
Laminated root rot	Douglas-fir, true firs, occasionally other conifers	Primary killer in many stands from the Nez Perce north; may be found with Armillaria or other root diseases.
Schweinitizii root rot	Douglas-fir, pines	Common in mature and overmature forests throughout the state; frequently associated with other root diseases and bark beetles.
Tomentosus root disease	Douglas-fir, subalpine fir, Engelmann spruce, lodgepole pine	Usually found as root/butt rot with other root diseases; occasionally causes mortality. Most common in southern Idaho, but present throughout the state.
FOLIAGE DISEASES		
Conifer-Aspen rust Conifer-Cottonwood rust	Aspen, cottonwood, conifers	Commonly observed on hardwood hosts in southern Idaho; some clones were severely defoliated.
Rhabdocline needlecast	Douglas-fir	Very widespread but very light levels statewide; incidence decreased in 1992.
Swiss needlecast	Douglas-fir	Widespread in north Idaho; generally at very low levels of infection.
Elytroderma needlecast	Ponderosa pine	Widespread throughout the state but more prevalent in drier climates; levels continues to decline in 1992.
Fir broom rust	True firs	Widespread throughout the state; usually of little consequence, but is pandemic in stands south of the Snake River in southern Idaho.

Fir needlecast	Subalpine fir Grand fir	Infection occurred at low levels throughout the host type.
Fir needle rust	Subalpine fir	Variable infection levels on young trees throughout host type.
Larch needlecast & blight	Larch	Both diseases occur throughout Idaho; detection in Southern Idaho was confounded by a severe late frost. In Northern Idaho there was an increase in localized areas of heavy infection.
Lodgepole pine needlecast	Lodgepole pine	Widespread throughout Idaho; infection levels were light in the south, but increased dramatically in the north in 1992.
Marssonina blight Shepard's Crook	Aspen	Scattered incidence of light to heavy intensity throughout most of host range.
Pine needle rust	pines	Scattered incidence of light to moderate intensity scattered throughout the host types in southern Idaho.
Phytopthora/Pythium root disease	Douglas-fir, spruce	Caused minor mortality of 2-0 seedlings in southern Idaho nursery.
Spruce broom rust	Engelmann spruce	Scattered through host range; most common in eastern Idaho.
White pine needlecast	Western white pine	Severe infections of lower crowns throughout north Idaho, especially near moist drainages.
NURSERY DISEASES		
Cylindrocarpon	esp. white pine whitebark pine	Common in soil or contaminated containers, usually a saprophyte but may be a weak parasite, caused losses at several nurseries.
Diplodia tip blight	esp. pines	Low levels in areas with a history of problems.
Fusarium root disease	Douglas-fir, larch, spruce, others	The most common and widespread nursery disease; amount of damage varies widely.
Grey mold	most conifers, esp. larch, spruce,	Common at low levels in many nurseries. Can be a serious storage problem.
Meria needlecast	larch	Infections levels were very low in 1992.
Phoma blight	most pines	Commonly isolated from seedlings and soil samples.
Sirococcus tip blight	spruce, pines	Found at low levels at several nurseries.

SUMMARY OF DISEASE AND INSECT PROJECTS

RATING FOR ROOT DISEASE SEVERITY. (Hagle) A root disease severity rating has been developed as a tool to assist in interpreting root disease effects. The severity rating is a subjective assessment based on the amount of change from normal in an area that is attributable to root disease effects. The rating is on a numerical scale from 1 to 10 and is best applied by people familiar with the local conditions.

The rating system can be used to rate plots on the ground or from aerial photographs, and is currently being used to provide information for Forest Plan revisions and broadscale analysis of forest health for Ecosystem Management applications.

ANNOSUS ROOT DISEASE. (Lockman) Preliminary results from the Nez Perce National Forest annosus root disease study were reported last year. The study involved very intensive examination of three pairs of stands, each pair consisting of a 10 to 30-year-old clearcut and an adjacent uncut stand, in the grand fir habitat type series. The project has now been completed and the most significant results and conclusions are as follows:

- Of the two "strains" of annosus root diseases, only the "S"-strain which infects true firs, Engaleman spruce and Douglas-fir was present in these stands.
- Spore infections are apparently the major means of introduction of annosus root disease into both the uncut and clearcut stands. Vegetative (root-to-root) spread is secondary in importance.
- Clearcutting significantly increased the frequency of annosus root disease in these stands.
- Uncut stands in the grand fir habitat types in this area are infected with annosus root disease, although at relatively low frequencies.
- Douglas-fir and grand fir have very similar disease incidence rates and are probably very similar in their susceptibility to infection by annosus root disease in these stands.
- Annosus root disease is not the only root disease present in these grand fir habitat type stands. It is often found in combination with other root diseases including Armillaria., Schweinitzii, and Perenniporia subacida.

A complete report on the final conclusions and results will be published soon.

ARMILLARIA/FERTILIZER STUDIES. (Schwandt) Inner bark was collected from the roots and tree bases of both healthy and armillaria infected trees on ten plots treated with three different fertilizer regimes. The bark was analyzed for a variety of chemicals including tannins, phenolics, sugars, and starches to examine possible differences between treatments and occurrence of Armillaria root disease. Results of the chemical analyses are expected in spring of 1993.

In a companion study, the University of Idaho has been applying similar fertilizer treatments to potted Douglas-fir seedlings. After almost two years, results indicate the fertilizer treatments had a significant impact on tree growth and vigor. However, no seedlings became infected with root disease even though each seedling had a block of Armillaria-infected wood placed next to the root system.

PONDEROSA PINE DECLINE ON THE FLATHEAD INDIAN RESERVATION. (Lockman) Extensive root disease and/or drought symptoms and associated mortality of ponderosa pine have been occurring on the west side of the Flathead Indian Reservation since the mid 1980's. Mature pines scattered throughout the forest have been dying at an unknown rate. Many crowns are thin, with needle retention lower than expected; terminal growth is poor; and in some cases, foliage color is chlorotic or appears to have a silver cast.

A project has been initiated to establish plots and monitor the decline of ponderosa pine on the Flathead Indian Reservation. Some questions we hope to answer with this project are:
- What are the causes of the decline and mortality?
- What is the rate of decline of individual trees?
- Are there predictable symptoms which can be related to time of mortality?

DWARF MISTLETOE PERMANENT PLOTS. (Taylor) Fourteen permanent plots were established on seven ranger districts in north Idaho and Montana during the summer of 1992 to monitor dwarf mistletoe spread, intensification, and effects on tree growth. Data from these permanent plots will be used to test and validate the Prognosis-linked dwarf mistletoe impact model and will also provide information on dwarf mistletoe effects on stand dynamics. Ten plots were located in stands infected with larch dwarf mistletoe; two plots were established in lodgepole pine stands with lodgepole pine dwarf mistletoe, and two were placed in stands with a combination of larch and lodgepole pine dwarf mistletoe. Plot sites represent 10 different habitat types, elevations range from 3600-7100 and the average ages range from 25-150 years-old. Baseline data analysis will be completed in 1993. Plots will be re-measured on a 5-year cycle.

DWARF MISTLETOE INFECTION OF YOUNG WESTERN LARCH. (Mathiasen) This study was begun in 1991 and continued in 1992. The objective is to determine the ages at which young western larch are initially infected by larch dwarf mistletoe. Young infected larch are being sampled and their age and height when fist infected determined by aging all mistletoe infections on each tree. Several temporary plots are being established around mistletoe-infected seed trees. Infection of young regeneration near the seed trees will be monitored for several years to determine infection rates in the regeneration over time.

EFFICACY OF MCH IN PREVENTING DOUGLAS-FIR BEETLE ATTACKS. (Gibson) A fieldtest has been planned to test the influence of MCH on tree infestation by Douglas-fir beetle. However, beetle populations were too low in 1992 to properly conduct the field test, so it was postponed to 1993.

EVALUATION OF A SEMIOCHEMICAL MOUNTAIN PINE BEETLE REPELLENT. (Gibson, Livingston) An aerial test of verbenone to repel mountain pine beetle was scaled down to a funnel trapping test due to lack of suitable test sites. Combinations of verbenone and an aggregative pheromone for the pine engraver (ipsdienol) were used to mask the attractant pheromones of the mountain pine beetle. Verbenone alone worked as well as the combination with ipsdienol, and further tests are planned for 1993.

PRUNING & THINNING EFFECTS ON WHITE PINE SURVIVAL AND VOLUME. (Schwandt) In 1969, a total of 48 one-quarter acre plots were established on five western white pine plantations in north Idaho. Four treatments were replicated at lower-, mid-, and upper-slope positions, and included: thinning and pruning white pine, thinning and pruning of all species, thinning only, and no treatment (control).

After 22 years, the plots that were pruned and thinned produced an average of 60% more merchantable volume than the controls and nearly 20% more than the plots that were thinned only. Although there were fewer white pine than other species in most plantations, the white pine in all plots had nearly twice the average volume per tree as the other species, and plots that were thinned and pruned saw the number of white pine increase by an average of 50%.

White pine mortality was cut by half in the thinned and pruned plots. In some cases, thinning alone resulted in greater white pine mortality than doing nothing.

Since the increase in volume on the pruned and thinned plots was primarily in white pine, its higher market value greatly compounds the benefits of the pruning treatment. In stands where natural western white pine is a desirable species, the additional investment of pruning white pine in conjunction with thinning should receive high consideration.

MONITORING OF FIELD PERFORMANCE OF BLISTER RUST-RESISTANT WESTERN WHITE PINE. (Mathiasen, Schwandt) This study is designed to monitor blister rust infection in F_1 and F_2 plantations operationally planted on state and federal land, particularly at high rust hazard sites. Permanent plots established in plantations representing different levels of rust hazard will be revisited to document changes or trends in blister rust infection and pine mortality. Young plantations (3-9 years) are being monitored because it is easier to distinguish between naturally regenerated and planted seedlings and to more accurately identify causes of mortality as it occurs.

Nine plantations on Idaho state lands have been surveyed thus far. All of the state plantations represent the F_2 generation of rust-resistant western white pine stock. Seven national forest plantations have been sampled. Two of these plantations represent F_1 stock and the remainder represent F_2 stock. Results for 1991-92are being summarized in a progress report that will be completed in early 1993.

RED TURPENTINE BEETLE DAMAGE IN PRUNED & EXCISED WHITE PINE. (Schwandt, Gast) A small project was initiated to monitor the potential effects of red turpentine beetle on white pine treated by pruning and excising to reduce blister rust losses. We have occasionally observed red turpentine beetle attacks associated with these treatments, but some stands on the Palouse RD, Clearwater NF, seem to have unusually high levels of attack and considerable mortality. Three plantations were surveyed in 1992. To get a better understanding of possible correlation between time of pruning or size of trees, We observed frequency of beetle attacks varied widely within plantations as well as between plantations (1-41%). Mortality also varied widely, but in one plantation 10 % of all trees sampled were dead and had been totally girdled by the red turpentine beetle. Monitoring will continue in several stands, and in one stand attacked trees were individually tagged to watch for continued beetle activity and future mortality.

BIOLOGICAL CONTROL OF FUSARIUM ROOT DISEASE. (James) An evaluation of the efficacy of Trichoderma harzianum to control Fusarium oxysporum on container-grown Douglas-fir seedlings (in cooperation with the University of Idaho) was recently completed. Results of laboratory and greenhouse studies indicated that strains of T. harzianum tested were not effective in limiting root disease caused by F. oxysporum.

An evaluation of Mycostop[R] biofungicide to control Fusarium root disease in container-grown Douglas-fir was recently completed (in cooperation with the University of Idaho). This biofungicide is a formulation of Streptomyces griseoviridis which is used as a seed dressing and applied topically. Data are currently being analyzed, but preliminary information indicates that this biocontrol agent may not be very effective in controlling Fusarium on Douglas-fir.

EPIDEMIOLOGY OF CYLINDROCARPON ROOT DISEASE. (James) Investigations into the epidemiology of Cylindrocarpon spp. in greenhouses are continuing. Evaluations include characterizing species involved in disease, assessing pathogenicity, and formulating procedures to improve control. An evaluation to investigate fate of Cylindrocarpon spp. and their role in outplanting performance will be started this spring (in cooperation with the University of Idaho and Potlatch Corporation).

PATHOGENICITY OF FUSARIUM SPECIES. (James) Investigations into the pathogenic potential of Fusarium spp. are continuing. Techniques have been developed to rapidly screen isolates for their potential as pathogens to conifer seedlings. These tests have thus far indicated that most isolates of F. proliferatum are much more aggressive than other species tested, including F. oxysporum. Fusarium proliferatum is well adapted to greenhouse environments, although the species is usually not a problem in bareroot nurseries. Efforts will continue to characterize the different fusarium species associated with conifer seedling roots, including those that might potentially be used as biological control agents.

FUNGUS GNATS AS VECTORS OF DISEASE IN GREENHOUSES. (James) Fungus gnats have been found to vector several different types of fungi in greenhouse environments. Most were yeast-like organisms, including Aureobasidium pullulans. Fusarium proliferatum was also frequently isolated from the bodies of fungus gnats collected in greenhouses.

USING CROPPING REGIMES TO CONTROL ROOT DISEASE IN BAREROOT NURSERIES. (James) An evaluation to determine efficacy of different cropping regimes to control root diseases was initiated at the USDA Forest Service Nursery, Coeur d'Alene. This evaluation will test effects of cover crops, soil amendments and fallow treatments on fungal populations and resulting disease in bareroot seedlings. The project is being conducted with the Intermountain Research Station.

DEVELOPING ALTERNATIVES TO CHEMICAL FUMIGATION. (James) A multi-regional project to develop alternatives to chemical soil fumigation for management of root diseases will commence in 1993. This project will entail trials at several nurseries in California, Oregon, Washington, and Idaho. The goals of the project are to develop alternative cropping regimes including soil amendments, cover crops, etc. and also develop procedures for differentiating pathogenic strains of Fusarium oxysporum collected from conifer nurseries. The project will include investigations by personnel from three Forest Service regions, several universities, private research laboratories, and state agencies.

CONE AND SEED INSECT MONITORING. (Gast) Black light traps are being tested in the Coeur d'Alene white pine seed orchard for use in detecting coneworm adults.

DOUGLAS-FIR TUSSOCK MOTH PERMANENT PLOTS. (Gast, Campbell) Permanent plots were installed on the Palouse RD, Clearwater NF in areas of historic tussock moth outbreaks. These plots will help calibrate/validate the DFTM extension of the PROGNOSIS model.

DOUGLAS-FIR TUSSOCK MOTH MATING DISRUPTION PILOT TEST. (Weatherby) This test was intended to demonstrate the feasibility of using a mating disruption technique as an operational suppression tactic. Pheromone loaded in fibers and mixed with a sticker was applied via helicopter to 600 acres in the Manns Creek drainage on the Weiser Ranger District, Payette National Forest.

Applications were completed in mid August 1991. Coverage appeared good and timely. Materials performed adequately. Treatment reduced the next years larval population by about 81 percent in treated versus untreated blocks. In treated blocks only 16 percent of emerged females produced fertile eggs versus 72 percent in untreated blocks. Treatment had no measurable effect on carpenter ants, western spruce budworm, or spiders.

In summary, efficacy is arguably as good, or better, than for most of the alternatives such as B.t., or conventional pesticides, but probably lower than that of the DFTM virus at high population densities where virus is likely most effective.

EFFECTIVENESS OF PYRETHRIOD INSECTICIDES FOR PROTECTION OF PONDEROSA PINE FROM ATTACK BY WESTERN PINE BEETLE. (Hoffman) Field work was completed on a three-year evaluation of nine treatments of five formulations of protective sprays around Idaho City, Idaho. Several treatments were replicated in Montana and in California.

USING PROTECTIVE SPRAYS ON PONDEROSA PINE TO PREVENT WESTERN PINE BEETLE ATTACKS. (Hoffman) Pine treatments of five formulations of pyrethoid sprays are being evaluated for effectiveness in protecting ponderosa pine from attack by western pine beetle. Field work has been completed on a three year study in ponderosa pine stands near Idaho City in southern Idaho. Several treatments were replicated in Montana and in California. Results are currently being analyzed.

EVALUATION OF A SEMIOCHEMICAL PINE ENGRAVER BEETLE REPELLENT. (Livingston, Gibson) This project is a continuation of the development of semiochemicals for use in preventing pine engraver (*Ips pini*) infestation of ponderosa pine slash. Lindgren funnel traps were baited with synthetic attractant pheromones of the pine engraver, then these were challenged by attractants of competing species which serve as antiattractants for *I. pini*. A combination of ipsenol and verbenone reduced the number of beetles caught by 95% compared to those caught by the attractants alone. The project was replicated in northern Idaho and Montana.

EVALUATION OF THE DURATION AND PERIODICITY OF PINE ENGRAVER AND DOUGLAS-FIR BEETLE FLIGHT. (Livingston) Flight was monitored using Lindgren funnel traps baited with pheromone attractants. In addition to the target beetles, many other insects associated with dead and dying wood were also caught in the traps. Both beetles were caught much later into the season than had been anticipated.

FIELD TEST OF TM BIOCONTROL-1. (Weatherby) A DFTM BioControl-1 rate study was conducted on the Boise National Forest near Featherville, Idaho during 1991 and 1992. Fifteen 40-acre plots were established and treatments consisted of applications of the labelled rate, half the labelled rate, and a no treatment control.

Pre-treatment larval populations were sampled within 72 hours of the spray application using lower crown beating techniques. Post-treatment samples were completed approximately 21 days after treatment. In addition, foliage samples were taken from all treatment blocks every five days and fed to lab colony larvae in order to determine the effective duration of the virus in the field.

Long term persistence in the soil was determined by taking soil samples from each plot prior to spray application and after the application in the fall of 1991 and in the spring of 1992.

Applications were completed on schedule during early July 1991. Coverage appeared to be satisfactory. Efficacy was unacceptable. Lab bioassays were initiated in order to determine why the application did not effectively reduce the population. Preliminary results from the bioassays indicate that effective dosages of TM BioControl-1 are much higher for field strains than for the Blue Lakes lab strain of tussock moth.

MOUNTAIN PINE BEETLE PERMANENT PLOTS. (Gibson) Permanent plots were installed on the Bonner's Ferry RD, IPNF's, in northern Idaho. These plots will help calibrate the Cole/McGregor mountain pine beetle rate of loss model for northern Idaho.

PERMANENT PLOTS TO VALIDATE THE DWARF MISTLETOE EXTENSION OF PROGNOSIS MODEL. (Taylor) The purpose of this ongoing, westwide project is to establish a database to validate and calibrate the dwarf mistletoe model linked to the Prognosis Stand Development Model. Seventeen new permanent plots were established on the Wasatch-Cache and Ashley National Forests. A database was created by FPM-MAG to house data from all types of permanent plots. This database may be useful for other types of data other than pest permanent plots. It could be used for timber and range plot data as well.

WESTERN SPRUCE BUDWORM PHEROMONE TRAP EVALUATION. (Campbell, Gast) The study to correlate the number of adult moths caught in pheromone traps with egg mass and larval densities and resulting defoliation continued on the Nez Perce NF and several forests in Montana.

WESTERN SPRUCE BUDWORM PERMANENT PLOTS. (Campbell, Gast) Permanent plots on the Nez Perce NF were remeasured for defoliation and budworm population estimates. These plots are part of a westwide project to validate and calibrate the western spruce budworm extension of the PROGNOSIS model.

WESTERN PINE BEETLE IMPACT MODEL. (Thier) This has been the first year of a model development project to predict the impacts of mountain pine beetle on ponderosa and lodgepole pine, western pine beetle, and Ips in western forest. The existing bark beetle models which are linked to the Prognosis Stand Development Model include mountain pine beetle for lodgepole pine and Douglas-fir beetle creating a need for a new model. Region 4 and FPM-MAG are the main cooperators of this project, along with a core group of personnel from different regions involved with bark beetle management and research. The model development work has been contracted to a private company, ESSA Environmental and Social Systems Analysts Ltd. ESSA has used a participation workshop format to collect information necessary to develop the prototype. The prototype model has been completed and is currently being reviewed by Forest Service cooperators. It is expected that the final model will be available for use by late 1993 and will most likely be linked to the Prognosis Stand Development Model.

COMMON AND SCIENTIFIC NAMES OF INSECTS

Balsam woolly adelgid	*Adelges picea* (Ratzburg)
Boxelder leafroller	*Caloptilia negundella* (Chambers)
Cone feeding adelgid	*Pineus coloradensis* (Gillette)
Cone moth	*Eucosma recissoriana* Heinrich
Cone worms	*Dioryctria* sp.
Cranberry girdler moth	*Chrysoteuchia topiaria* (Zeller)
Douglas-fir beetle	*Dendroctonus pseudotsugae* Hopk.
Douglas-fir tussock moth	*Orgyia pseudotsugata* McDunnough
Fir engraver	*Scolytus ventralis* LeConte
Gypsy moth	*Lymantria dispar* (L.)
Mountain pine beetle	*Dendroctonus ponderosae* Hopk.
Pine engraver	*Ips pini* (Say)
Silver fir beetle	*Pseudohyesinus sericeus*
Spruce beetle	*Dendroctonus rufipennis* (Kirby)
Western balsam bark beetle	*Dryocoetes confusus* Swaine
Western conifer seedbug	*Leptoglossus occidentalis* Heidmann
Western pine beetle	*Dendroctonus brevicomis* LeConte
Western pine shootborer	*Eucosma sonomana* Kearfott
Western spruce budworm	*Choristoneura occidentalis* Freeman

COMMON AND SCIENTIFIC NAMES
OF
DISEASES

Annosus root disease	*Heterobasidion annosum* (Fr.) Bref.
Armillaria root disease	*Armillaria ostoyae* (Romagn.) Herink
Atropellis canker	*Atropellis piniphila* (Weir) L. & H.
Black stain root disease	*Leptographium wagneri* (Kendr.) Wingf.
Brown cubical butt rot	*Phaeolus schweinitzii* (Fr.) Pat.
Comandra blister rust	*Cronartium comandrae* Pk.
Conifer-Aspen rust	*Melampsora medusae* Thum.
Conifer-cottonwood rust	*Melamspora occidentalis*
Cylindrocarpon root disease	*Cylindrocarpon* spp.
Cytospora canker of firs	*Cytospora abietis* Sacc.
Diplodia tip blight	*Sphaeropsis sapinea* (Fr.) Dyko
Dutch elm disease	*Ceratocystis ulmi* (Buism.) C. Mor.
Dwarf mistletoes	*Arceuthobium* spp.
Elytroderma needlecast	*Elytroderma deformans* (Weir) Dark.
Fir broom rust	*Melampsorella caryophyllacearum* Schroet.
Fir needlecast	*Lirula abietis-concoloris* (Mayr:Dearn) Darker
Fir needle rust	*Pucciniastrum epilobii* Otth
Fusarium root disease	*Fusarium* spp.
Grey mold	*Botrytis cinerea* Pers. ex Fr.
Indian paint fungus	*Echinodontium tinctorium* (Ell.& Ev.) Ell. & Ev.
Laminated root rot	*Phellinus weirii* (Murr.) Gilb.
Larch needle blight	*Hypodermella laricis* Tub.
Larch needlecast	*Meria laricis* Vuill.
Lodgepole pine needlecast	*Lophodermella concolor* (Dearn.) Dark.
Marssonina blight	*Marssonina populi* (Lib.) Magn.
Phoma blight	*Phoma* spp.
Pine needle rust	*Coleosporium* sp.
Pythium root disease	*Pythium ultimum* Trow.

Red ring rot	*Phellinus pini* Pilat.
Rhabdocline needle cast	*Rhabdocline pseudotsugae* Syd. *Rhabdocline weirii* Parker & Reid
Schweinitzii root/butt rot	*Phaeolus schweinitzii* (Fr.) Pat.
Shepard's crook	*Venturia macularis* (Fr.) E.Muller & Von Arx
Sirococcus tip blight	*Sirococcus strobilinus* Preuss.
Stalactiform rust	*Cronartium coleosporioides* (Diet. & Holw.) Arth.
Spruce broom rust	*Chrysomyxa arctostaphyli* Diet.
Spruce mottled needlecast	*Rhizosphaeria kalkhoffii Bud.*
Swiss needle cast	*Phaeocryptopus gaeumannii* (Rhode) Pet.
Tomentosus root disease	*Inonotus tomentosus* (Fr.) Gilb.
Western gall rust	*Endocronartium harknessii* (Moore) Hir
White pine blister rust	*Cronartium ribicola* Fisch.
White pine needlecast	*Lophodermella arcuata* (Darker) Darker

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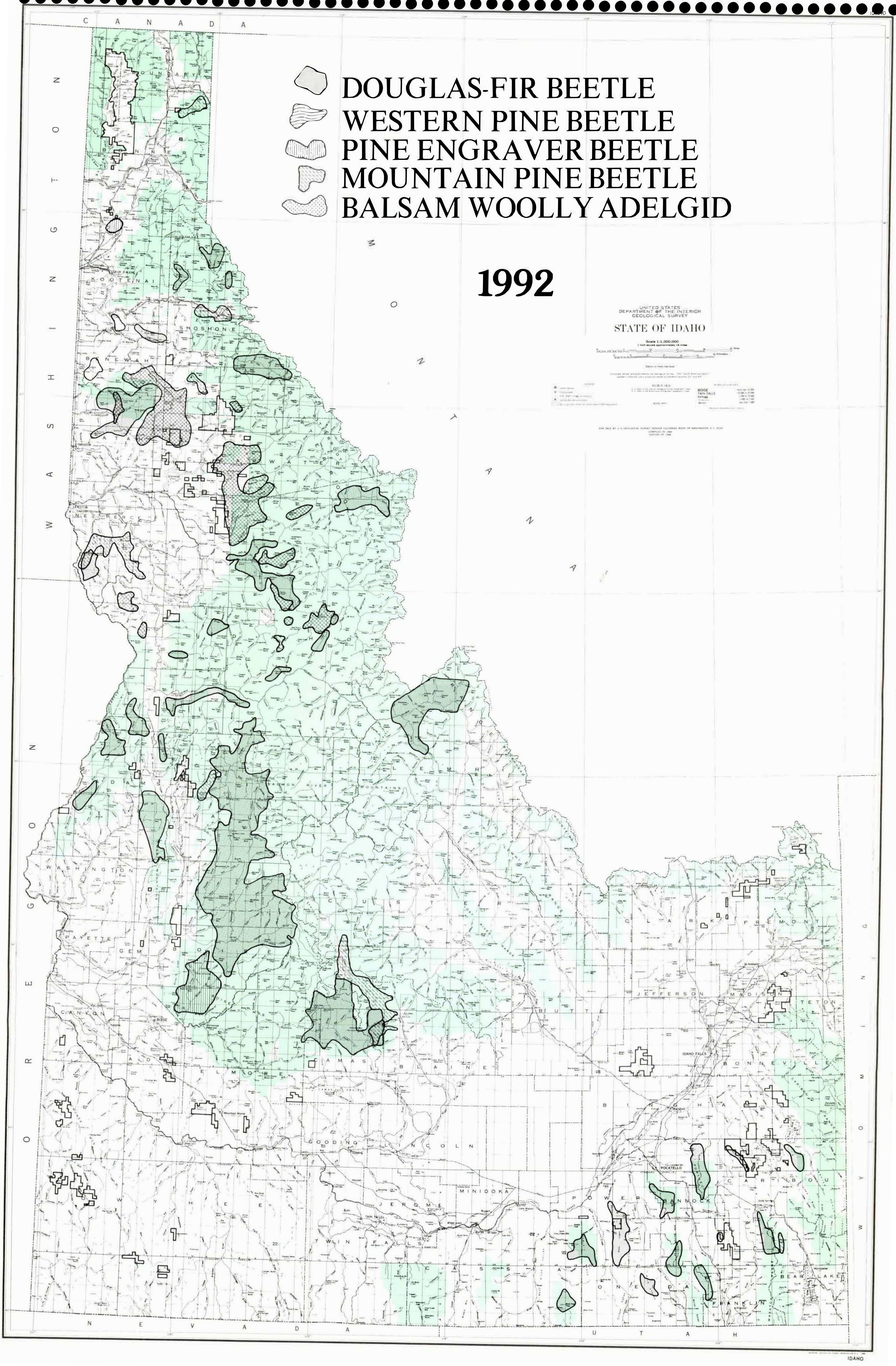
DOUGLAS-FIR BEETLE
WESTERN PINE BEETLE
PINE ENGRAVER BEETLE
MOUNTAIN PINE BEETLE
BALSAM WOOLLY ADELGID
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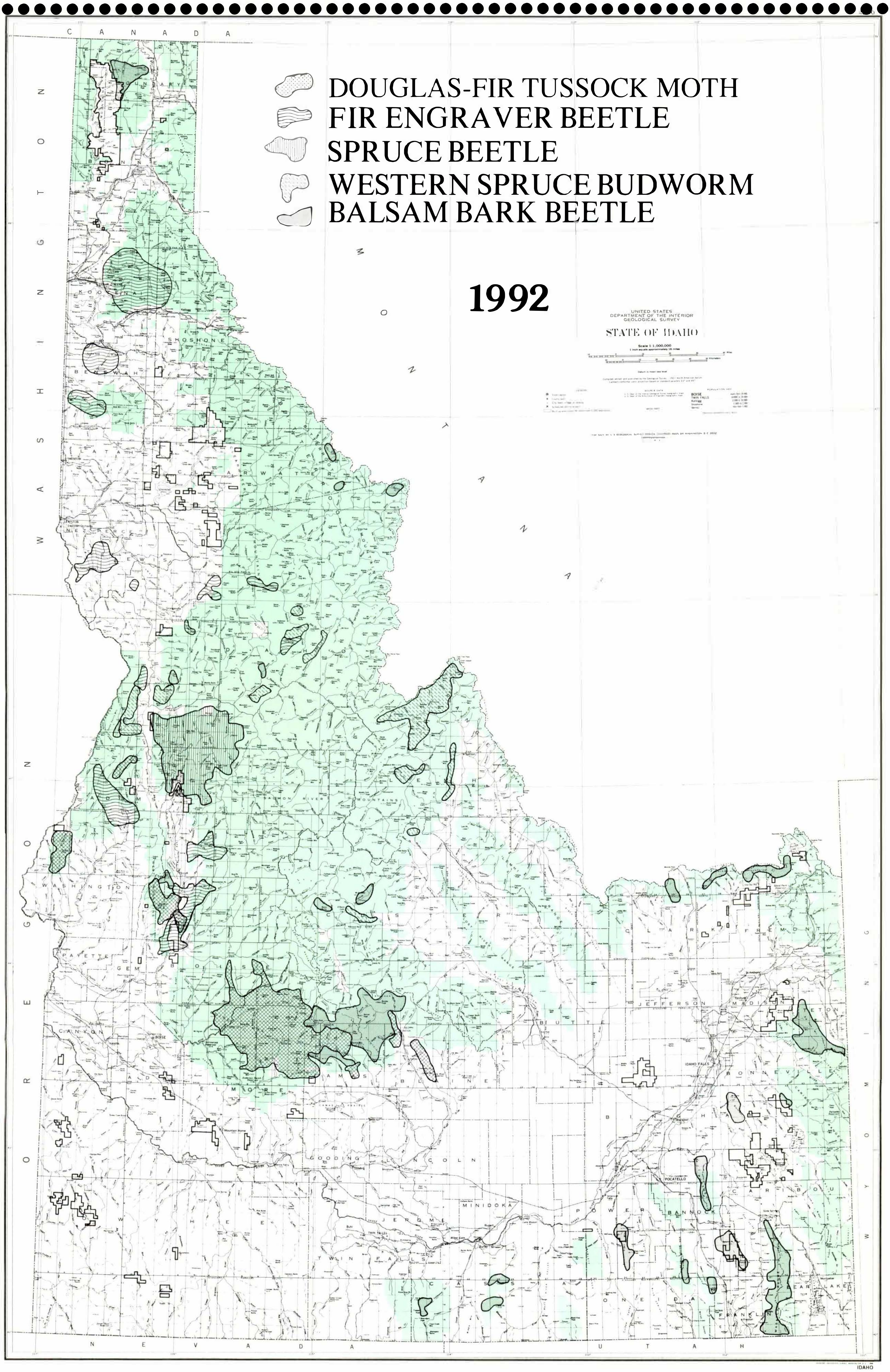
DOUGLAS-FIR TUSSOCK MOTH
FIR ENGRAVER BEETLE
SPRUCE BEETLE
WESTERN SPRUCE BUDWORM
BALSAM BARK BEETLE
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